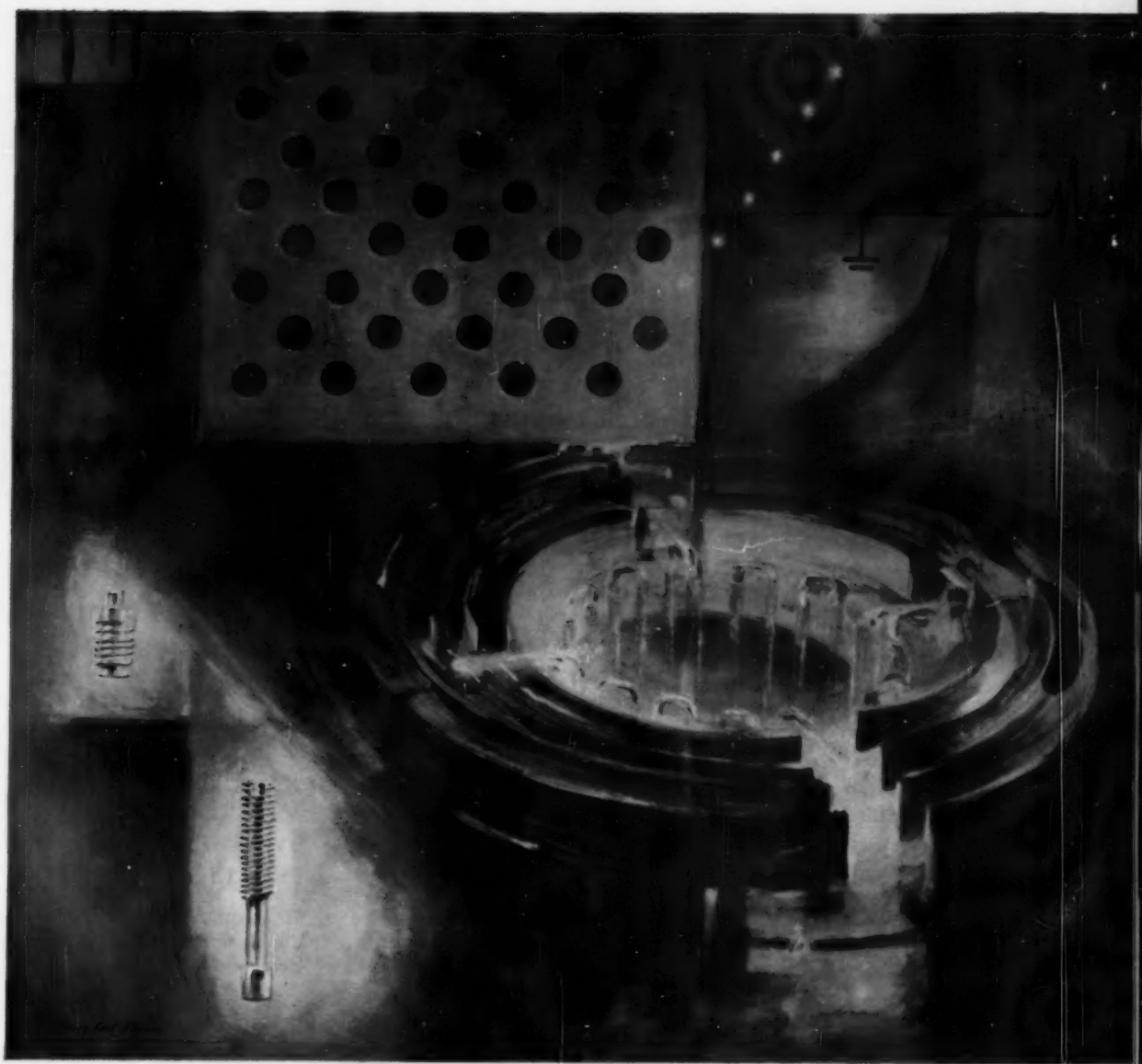
JUNE 27, 1960

American Machinist / Metalworking Manufacturing

A McGRAW-HILL Publication • Seventy-Five Cents



Techniques to Machine Molybdenum:

Turning
Threading
Drilling
Reaming
Grinding
Chemical Milling
Electrical Discharge Machining
Chip Conservation

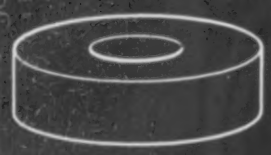
Special Report, page 121

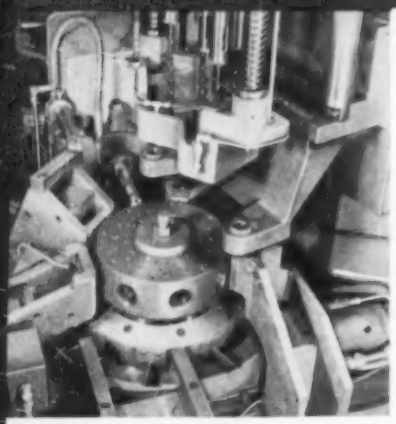
170 OPERATIONS

78 HOLES

starting from solid

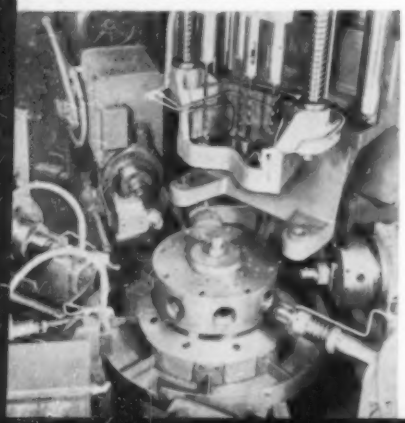
- DRILL
- REAM
- BORE
- COUNTER-BORE
- GROOVE
- TAP





Above — Work stations on first machine (shown in large photo)

Below — Work stations on second machine



Two 6-station Model S Bore-Matics

UP PRODUCTION 519%

This cast-iron hydraulic motor body used to be produced on three different machines, with a total production time of 286 minutes per part. Now it is done on two 6-station Model S Bore-Matics in *46 minutes!*

Each machine is equipped with Heald Red Head Borizers to rotate and feed the tooling, and a rotary indexing workholding fixture. Once the part is loaded, all operations are performed in sequence in a fully automatic cycle. After operations on the first machine are completed, the work is turned over and put on the second machine where the remaining operations are finished from the opposite face.

This job demonstrates the unusual versatility of Heald Borizer units—and their ability to handle heavy stock removal while maintaining required accuracy for each of numerous sequential operations. For complete details on this particular application, send for a copy of the April 1960 issue of the "Heald Herald."

MMT-PE

It PAYS to come to Heald

THE **HEALD** MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

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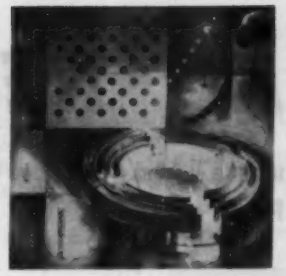
CIRCLE 151 READER SERVICE CARD

Cover:

Oil painting by H K Stoessel, executed for Climax Molybdenum Co, shows furnace radiation shield, small electronic parts, and a heat exchanger for corrosive liquids; all of molybdenum alloys, see p 121.



American Machinist / Metalworking Manufacturing

contents for June 27, 1960

VOLUME 104, NO. 13

This Metalworking World: Britain—land of insecure prosperity . . . First of a series of on-the-scene reports from the world's metalworking capitals. *By Nicholas Landon and John Shinn* **99**

Red Chinese tractor works exceeds designed capacity **104**

Mass producing aluminum engines **105**

Blowing bubbles is serious business at Bell . . . Helicopter canopies are blown from acrylic plastic in 50 min—down from 7 hours **106**

Ribbon wrapping makes thrust chambers . . . Manufacturing method developed by NASA and used at Solar makes light, strong thrust chambers.. **108**

New classification for gears nears adoption **110**

Giant crystals break a machining barrier **111**

Coil size plus mechanization make steel strip competitive **112**

Share-the-parts plan cuts engine costs . . . 85% common parts in Chrysler V-8 engines smooth production problems. *By George DeGroat* **113**

Mixed scrap won't bring top dollar . . . The "trouble" of segregated scrap is worth it. *By Robert H Clymer, Clymer Associates, Inc.* **116**

Simple tooling for soldering **116**

Hand assembly holds precision on computer parts . . . Memory-core units for automatic systems are best put together by hand. *By F R McElligatt, Burroughs Corp.* **117**

Portable dimpler gets into tight space **119**

Double transfer cuts pallets, keeps accessibility . . . Work pallets skip the idle stations on new machine **120**

SPECIAL REPORT NUMBER 491

Better techniques machine molybdenum . . . A five-part report on current practice **121**

1. **Experimental machining at Custom Tool** **121**
2. **Where to start grinding molybdenum** **124**
3. **Chemical milling works molybdenum** **125**
4. **Why molybdenum is a tough metal to machine** **126**
5. **Electric discharge deep-trepans molybdenum** **127**

REFERENCE BOOK SHEETS

Control of U-shaped bends, I, II . . . An efficient way to control springback. *By Bernard K H Bao, Cribben & Sexton Co.* **133**

Solid-carbide routers . . . New standards of the Solid Carbide Tool Institute **137**

TURN PAGE FOR METALWORKING REPORT—→

Trends . . .

Metalworking Report .. 2
Spot News .. 81
Washington .. 83
Detroit .. 85
Aircraft and Missiles .. 87
Machine Tools .. 89
Materials .. 91
What's Ahead .. 93

Departments . . .

Letters .. 72
Calendar .. 75
Editorial .. 97
Talking Shop .. 141
Practical Ideas .. 142
New Equipment .. 145
Field Report .. 171
Memos .. 186
Names .. 197

METALWORKING REPORT

Significant current developments in tooling and production processes

CUTTING

Hot Machining

Tool-life improvements of up to 5 times normal on AM 350 and 20 times normal on 4340 are reported when turning at 900 F. In face milling, improvements of 20 times in tool life on 17-4 Mo and 100 times on Thermold J are reported at 1000 F. Hot drilling has shown no improvement over drilling at room temperature.

These results are said to be among the conclusions reported in the first stage of a thorough study of the possibilities of hot machining for cutting superalloys and other difficult-to-machine metals. The study has been undertaken for the Manufacturing Methods Div of Air Materiel Command by The Cincinnati Milling Machine Co.

Limiting temperatures in milling occur when chips begin to weld to the cutter at around 1100 F, according to reliable sources who have seen the report. Principal need now is to find ways to localize heat in the area of cutting to minimize distortion, tempering, and other problems connected with hot machining.

Deep-Trepanning Molybdenum

It wasn't bad enough that Picatinny Arsenal had to trepan a deep (16 in.) hole in a high-temperature probe, but the probe had to be made of molybdenum; and it wasn't a simple hole, but a groove with inside dimension at 0.375 and outside 0.565 in. Electric-discharge machining did the job, with an Elkonite-tipped tool and with the work rotated slowly to equalize possible runout. It took several sample pieces and considerable experience to master the tricky job, but it finally worked.

This job is detailed and other cutting operations on molybdenum are illustrated in a Special Report beginning on page 121.

FORMING

More Efficient Sintering

Maximum usage of the power source is a prime way of getting more efficiency in production of sintered alloy blocks. By hooking three presses to one 100-kw high-frequency generator, three presses now turn out more parts per day, in larger sizes, and at less cost per piece.

The installation was engineered by Induction Heating Corp, Brooklyn, NY. Materials up to 7 in. long, 4 in. wide, and from 0.2 to 0.6 in. thick can be processed at one time. At maximum temperature and pressure, the heat-treating and cooling process requires 10 min. Output of 250 units per day has been reached.

Each platen press incorporates heating and pressing means. A hydraulic cylinder on the lower platen operates under control of a 3-range pressure system, the maximum compacting pressure being 28 tons. The upper platen embodies an air cylinder to lower and raise the induction coil that heats the work and the heat sink (water cooling system) that cools the work at optimum rate.

The three presses can be used for similar or dissimilar jobs. Each press is equipped with an interlock and memory circuit to allow its individual rise. Timers can be adjusted for various applications.

Versatile 4-Slide

Horizontal or vertical 4-slide machines have been built for many years, but now we have one that can operate horizontally, vertically or at any angle in between. This development means that wire forming and press working on ribbon stock, where forming is needed on several planes, can now be done in the most effective position for application of tooling, maintenance, forming and ejection of the work, and slug ejection.

The entire frame of the machine pivots much like an OBI press. Actually, the machine is sometimes used like an inclinable press for the same reason—easy ejection of the work by gravity.

The model RWI-1 is rated as a No. 1, will take tooling made for older non-inclinable No. 1 machines. But whereas the older machines accepted ¾-in. ribbon stock, the new model will take up to 1½-in. ribbon or 3/32-in. wire. Feed length is 8½ in. maximum.

Forming slides have ½-ton capacity, but the press unit is rated at 4 tons. A symmetrical press unit is now used, so that it can be placed at front or back of the metal line, to put the burr on the stock side you require. Two units can be mounted and die sets can be used.

Operating speeds of 75 to 300 strokes per min are obtained from a variable-speed drive. Machine can be tied in with automatic equipment to receive, form, and eject a part without restriction because of its operating position. It will be exhibited at the Machine Tool Exposition by Baird Machine Co, Stratford, Conn.

INSPECTION

Balls Make V-Block

Four balls locked together atop a flat ground plate make a V-block that is accurate to 0.0002 in., but is competitively priced. The balls are held in a chase fastened to the plate, and are separated into two pairs by an accurate spacer.

Four-point contact for the workpiece is provided, because balls are readily selected to the above precision. If wear does take place, the balls can be unlocked and rotated to provide new contact points. By using a spacer between two pairs of balls, V's of unequal angles can be created.

Clamps can be applied to the block to hold parts for inspection or machining. If desired the bases can have their sides accurately finished in respect to squareness and flatness.

The ball blocks can be used for surface finish measurements on workpieces in either the longitudinal or circumferential directions. The surface finish on the balls (0.2 microinches) certainly aids such inspection.

The "B" block will support spherical components in a large range of diameters. With special bars, a block can be used to check the accuracy of squares. Rubert & Co, Demmings Road, Cheadle, Cheshire, England, devised the "B" block.

Interferometric Inspection

Fast inspection machine, based on the principle of interferometry and said to be capable of doing any two-dimensional inspection problem 3 to 50 times as fast as by conventional methods, made its U S debut at the just-closed British Exhibition in New York. Idea of the machine is to speed up component inspection to keep up with output. Two free-moving precision slides are mounted over machine's 49½ x 34½ x 6-in.-deep table, so that a probe or optical finder can be moved to any desired point (to check, for example, location of a hole in relation to a master location). Slides, fitted with diffraction grating measurement systems show x and y coordinates (lateral and longitudinal location) of the hole. This shows up on an illuminated six-digit counter, which tells distance from hole to hole to an accuracy of 0.001 in. If machine is fitted with a straight shaft of known diameter (instead of the regular tapered shaft), it can be used for inspection of profiles and helices. Soon to be marketed here by Bendix Corp, machine operates on 110 volts, 60 cycles.

Quicker Balancing

General Motors is building two static balancing machines that get the answer in 30% of the time required by units that must spin the part. One machine will balance a blower wheel 2 ft. dia by 1 ft wide. The other machine is a fully automatic brake-drum balancer with four automated stations: center, measure amount of unbalance and location, index to position for welding, and welding.

Current work indicates that precision parts can be balanced to 0.01 oz. in. in an average cycle time of 3 seconds.

GM's principle of static balancing is one of electromagnetic detection of the amount and angle. In the experimental model, a frictionless ball pivot is attached to a work fixture. Hanging from the fixture is a tube that extends slightly into a chamber containing silicone fluid to dampen pendulum action. About halfway up the tube is a 4-pole stator, or electromagnet, that does not restrict the tube's movement in the magnetic field.

The principle is this: The change in magnetic reluctance between each pole face and the tube is measured when an unbalanced part swings the tube to an off-center position. Damping action of the silicone moat brings the assembly to rest in one or two seconds. Changes in reluctance are combined electronically to produce two independent signals. One represents the amount of unbalance, the other the angular location.

The semi-automatic experimental machine has already been used successfully in production to balance 2-lb.-, 5-in.-dia transmision parts to ¼ oz-in.

THE OUTLOOK:

Metalworking production has risen to 108 on the AM/MM index for the month of June. Cutting tool sales show a strong upswing, and bearing manufacturers report good, steady business. Manufacturers' sales of home appliances are lagging. Gear manufacturers expect continued good business through the rest of the year. *See page 93.*

WELDING

Cleaning with Flap Wheels

Multi-paddled grinding wheels help make better resistance seam welds in a new automatic line built for Inland Steel Container Co by National Electric Welding Machines Co. Flat sheets, either hot-rolled or cold-rolled, are fed past two pairs of grinding wheels that clean rust, dirt, and scale from top and bottom of both edges of the sheet.

The developers claim the method eliminates grinding-wheel dressing and the constant maintenance required by conventional methods. The flap wheels—Minnesota Mining & Manufacturing Co's PG coated abrasive wheels—are made of flexible cloth and can follow hills and valleys that would be ground thin or missed completely with a rigid wheel.

In the new container line at Inland, automatic controls raise the wheels as each sheet advances to grinding position to avoid damage to the wheels. Too, a timing mechanism automatically compensates for wear by bringing the wheel closer to the work at a predetermined rate.

HEAT TREATING

Automatic Heat Treating Line

Roller bearing parts are automatically heat treated at Bower Roller Bearing Co, Detroit, in highly mechanized furnace lines. Lift truck loading of parts is the only manual operation. Twelve men can control the operation of 22 furnaces through a 24-hr period.

When completed, this installation at Bower will involve 44 furnaces, many of them new, some being moved in from other buildings. Surface Combustion, a division of Midland-Ross Corp, supplied four of the new furnaces. Two are set up for carburizing, one each for hardening and drawing. Capacity of the entire installation at the moment is two tons of parts per hour.

FINISHING

Diamond-Belt Polishing

Carbide dies for bar drawing are polished at Chase Brass by diamond-impregnated nylon belts on machines by Hartford Special. This beats hand-polishing costs by 50:1, because of the sharp speed-up in production rate.

The belts are from 3/16- to ⅜-in. wide and impregnated with 100-mesh to 300-mesh diamond particles. The worktable rotates the round carbide dies at around 100 rpm, and belt speed is 5000 fpm. Belt-life limits have not been fully established, but one belt has polished 200 dies.

Look—No Hands

Installed on the roof of the Arnold, Schwinn bicycle plant, Chicago, a fully automatic pre-paint treatment department, built by the R C Mahon Co, operates without any personnel,

except those making periodic checks. Bicycle frames are handled on an overhead conveyor at a speed of 12 fpm, treatment time being 8 min per part.

Completed frames are sprayed at 15 psi with a solution of detergent and iron phosphate at 150 F, rinsed with water at room temperature, sprayed with an iron phosphate solution at 150 F, rinsed again, and finally sprayed with a chromic-phosphoric acid solution at 135 F. Following a 5-min trip through a gas-fired drying oven at 400 F, work is air cooled for 10 min, then dipped in red synthetic primer, drained for 5 min in a solvent-vapor tunnel, and finally dried in a gas-fired oven at 360 F.

MATERIALS HANDLING

Non-Contact Conveyor

Hot work—even molten glass—and parts with delicate surfaces can be handled on a new conveyor chute developed by Corning Glass Works. Made of Cormet A, the working surface of the chute is porous and is backed up by an ordinary metal duct. Air at 15 psi is pumped into the space between the duct and the working surface and escapes through the porous Cormet at the rate of 5½ cfm. Work passing down the chute thus rides on a cushion of air and never touches the surface of the chute. If surface oxidation must be avoided, an inert gas may be used.

Maximum operating temperature of the Cormet is 630 F, but this is of no significance in this application, as the work never actually touches it. If necessary, the principle may be used in reverse; that is, air may be drawn in through the pores to hold work in contact with the conveyor, either continuously or at predetermined positions in the travel zone.

Mechanical Crab

A fork-lift truck that can move sideways, as well as back and forth, has been introduced by Materials Handling Equipment (Great Britain) Ltd. Called the Iron Lizard, it has a capacity of 3300 lb. Two driving wheels, fore and aft of the unit, each powered by a separate electric motor, can be turned in any direction by a control in the driver's cab, the truck being raised on automatic jacks during the turning operation. The arrangement permits a truck to move down an aisle and then into and out of a stack without difficulty.

MATERIALS & COMPONENTS

Machinable Stainless

Called Type 303-MA, a new sulfurized 18-8 stainless-steel alloy containing up to 1% aluminum is, in field tests, exceeding the fondest hopes of its developers. Production rates, tool life, and surface finish all show improvements of 15 to 30% over standard free-machining Type 303. An outstanding, and somewhat unexpected, benefit with 303-MA is a resistance to corrosion at least 20 times better than conventional 18-8 alloys.

A product of Universal Cyclops Steel Corp, Bridgeville, Pa, and now available in the full range of stock sizes, the new alloy bars and rods are said to be highly resistant to longitudinal splitting. At a price little or no higher than conventional sulfurized 303, the company feels that the new metal will prove exceptionally popular for fasteners produced by cold heading and/or machining, as well as for forgings and screw-machine products. Welding characteristics, generally poor for Type 303 alloys, are not yet fully tested for the new material but its corrosion resistance suggests that one problem of conventional 303 welding, intergranular corrosion, may be reduced.

Workable Refractory Metals

Bars of refractory metals, such as tungsten, can now be grown as single crystals by an arc fusion process developed by Linde Co. Largest crystal (called a boule) now available is about ¾-in. dia and 12 in. long, but larger sizes are possible. Single crystals can be machined and formed at temperatures well below those for the same metals in sintered or vacuum-melted form. Details of this development are given in the article on page 111.

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American Machinist/Metalworking Manufacturing, published bi-weekly by McGraw-Hill Publishing Company, Inc. James H. McGraw (1860-1948), Founder.
EXECUTIVE, EDITORIAL, CIRCULATION, ADVERTISING and PUBLISHING OFFICES: McGraw-Hill Building, 330 West 42nd St., New York 36, N. Y. OFFICERS OF THE PUBLICATIONS DIVISION: Nelson L. Bond, President; Shelton Fisher, Wallace F. Traendly, Senior Vice Presidents; John R. Callaham, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; A. R. Venezian, Vice President and Circulation Coordinator. OFFICERS OF THE CORPORATION: Donald C. McGraw, President; Joseph A. Gerardi, Hugh J. Kelly, Harry L. Waddell, Executive Vice Presidents; L. Keith Goodrich, Vice President and Treasurer; John J. Cooke, Secretary.
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United States subscription rate for individuals in the field of the publication $3.00 per year, single copies 75 cents, Canada $4.00 per year, foreign $25.00 per year, payable in advance. Second-class postage paid at New York, N. Y. Printed in U. S. A.
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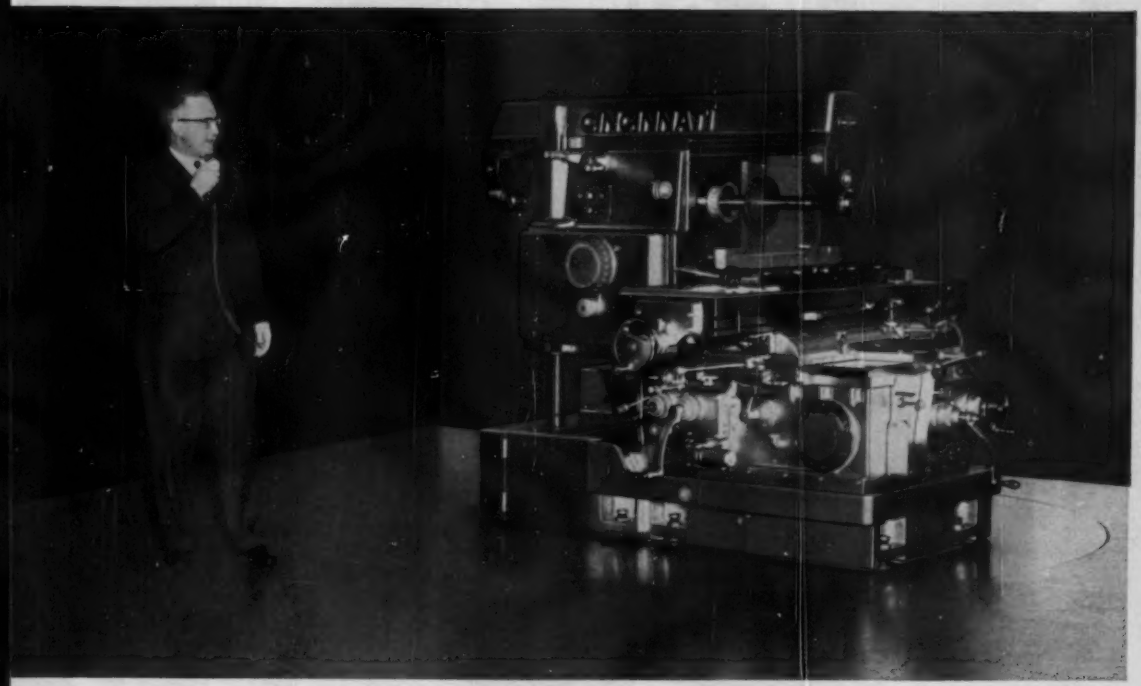
...and now, gentlemen, meet

VERCI POWER

CINCINNATI'S NEW ALL-PURPOSE MILLING MACHINE



VerciPower pioneers a unique new design. It combines the preferred advantages of two basic types of milling machines: knee and column, and manufacturing.

Jack Lynch, Manager of Milling Machine Sales, takes the mike and outlines what VerciPower can do for you . . . "increase production through a high degree of flexibility, easy operation and automatic table cycles . . . mill a great variety of materials by means of its wide range of feeds and speeds . . . reduce maintenance time through the use of readily accessible unit assemblies . . . cut operating costs by performing a greater variety of jobs."

In VerciPower, as in other Cincinnati developments such as ACRAMATIC Numerical Control systems, electrical discharge machining, and "chipless" machining, Cincinnati Milling offers you the very latest in metalworking equipment and methods. Read more about the new VerciPower on the two pages following. Then discuss your machining problems with our Field Engineers. **Milling Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**

KNEE TYPE AND BED TYPE MILLING MACHINES • DIE SINKING MACHINES
• CUTTER AND TOOL GRINDERS • ELECTRICAL DISCHARGE MACHINES

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NEW VERCI POWER

LOW-SLUNG AND POWERFUL, *the new VerciPower offers unusual flexibility for toolroom and production milling. Dual operating controls at front and left rear provide utmost operator convenience.*

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ALL-PURPOSE MILLING MACHINE
VERSATILE...POWERFUL...FAST

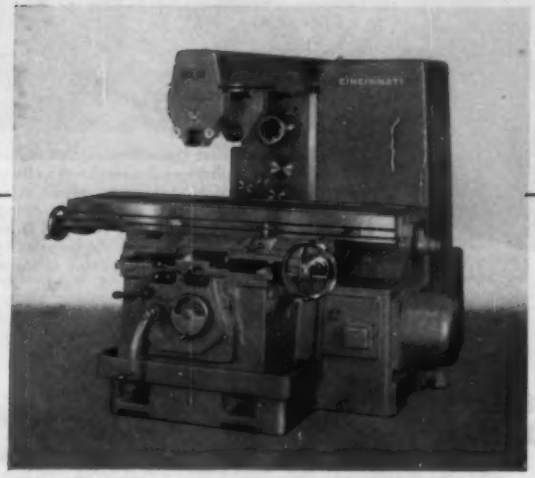
VerciPower gives you an opportunity to take a big bite out of machining costs. VerciPower . . . the unique new all-purpose milling machine that combines toolroom flexibility of knee-types with the rigidity and cutting capacity of manufacturing and bed type machines.

Low-slung powerful construction is the key to VerciPower's inherent ruggedness and speed. The saddle and table move directly on the machine bed of convenient fixed height—there is no movable knee. Vertical movement is provided by the spindle carrier. Hardened ways, narrow guides and square gibbing on both bed and headstock maintain the original built-in accuracy for years.

VerciPower incorporates many outstanding feature-advantages:

- Two complete and independent sets of controls, one at front and one at rear for maximum operating convenience
- Arbor-Loc spindle nose, to simplify and speed the changing of cutters
- Fixed table height of 39″—easier to load and unload work
- Table traverse handwheel at the front; a desirable setup convenience
- 24 spindle speeds and 32 feed rates (in geometric progression), selected by power from front or rear
- Automatic Backlash Eliminator, for climb or conventional milling
- Dynapoise overarm; an exclusive Cincinnati feature that damps self-excited chatter, smoothes the cutting action
- Automatic table cycles—standard equipment on all sizes

VerciPower is a new mighty work horse, expertly designed and equipped to handle a great variety of your milling operations. May we give you more information? Write for new catalog M-2130, or a visit by one of our field men.



CINCINNATI

MMT-PE

Booth No. 1034

CINCINNATI VERCIPOWER MILLING MACHINES *for all-purpose milling are available in four sizes: 20 or 30 hp, 34″ or 42″ table travel, each with 22″ vertical travel of spindle carrier. New catalog No. M-2130 contains complete specifications.*

CUTTER AND TOOL GRINDERS • ELECTRICAL DISCHARGE MACHINES

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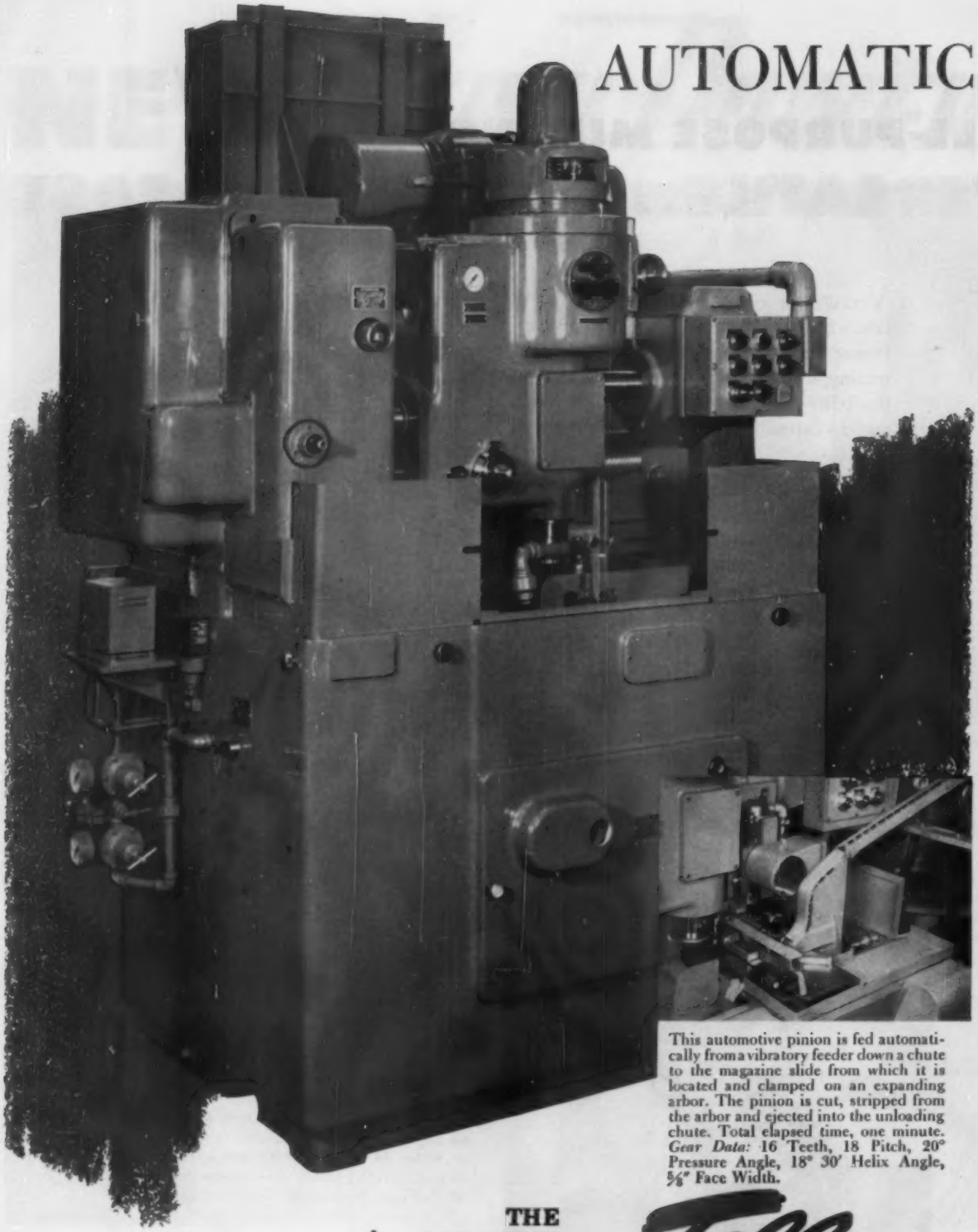
AUTOMATIC



This automotive pinion is fed automatically from a vibratory feeder down a chute to the magazine slide from which it is located and clamped on an expanding arbor. The pinion is cut, stripped from the arbor and ejected into the unloading chute. Total elapsed time, one minute. *Gear Data:* 16 Teeth, 18 Pitch, 20° Pressure Angle, 18° 30′ Helix Angle, 5/8″ Face Width.

THE PRECISION LINE

Fellows

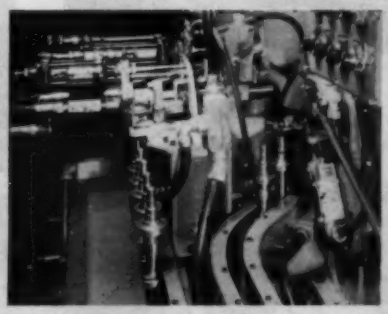
WORK HANDLING
Is A Natural Complement to the High Production Rates of the Fellows 4GS Gear Shaper

Although designed for both manual and automatic loading, the 4GS Fellows Gear Shaper makes best use of its high production rates when equipped with work handling devices.

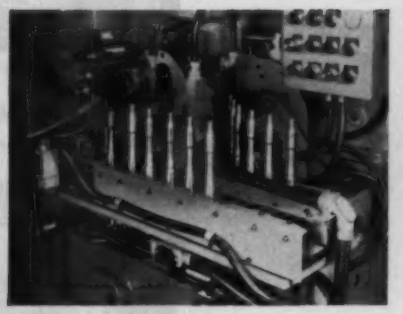
The physical construction of the machine is such that it may be easily adapted for use with magazines and chutes for automatic loading and unloading at substantial cost savings on continuous production runs.

Ask your Fellows representative about the many advantages of automatic work handling with the 4GS Fellows Gear Shaper, or write direct to the Fellows Gear Shaper Company.

These internal clutch parts are handled in the same manner as the 16-tooth external pinion, except that the cutter-spindle is automatically stopped at the top of its stroke for clearance during the loading and unloading cycle. Cutting time is 1½ minutes. *Gear Data:* 10 Teeth, 12.4 Pitch (Stubbed), 30° Pressure Angle, Spur, 5/32" Face Width.



This transmission cluster gear shaft is handled by two sets of air-operated "fingers" mounted on a turret. As the turret rotates, one set of fingers moves the finished piece to the unloading chute while the other set brings the new blank into position. Cutting time is 35 seconds. *Gear Data:* 10 Teeth, 12.4 Pitch (Stubbed), 30° Pressure Angle, External Spur, 5/32" Face Width.



This automotive stem pinion is handled in the same manner as the cluster gear. In both cases, safety devices prevent the machine from starting unless the blanks are in the correct cutting position. Loading and unloading chutes may be hand or conveyor fed. Cutting time is 2½ minutes. *Gear Data:* 17 Teeth, 10 Pitch, 19° 30′ Pressure Angle, 32° 51′ Helix Angle, 5/8" Face Width.

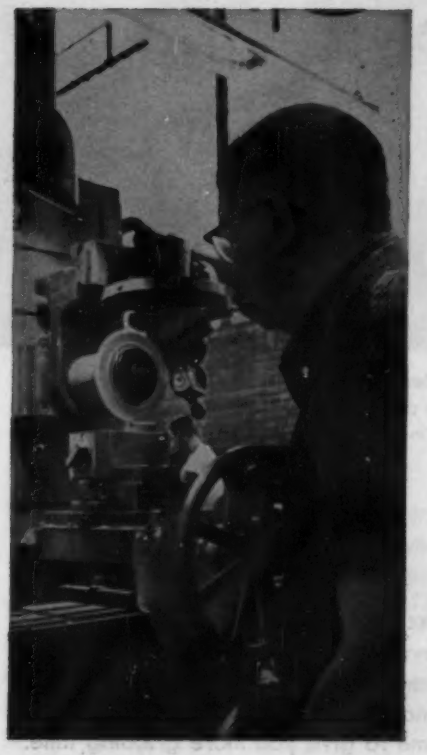
Gear Production Equipment

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont, U. S. A.
Branch Offices:
1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

Taps—Collapsible
& Solid Adjustable

Centerless Thread
Grinding Machines

Threading Machines



IN WAYNESBORO, PENNSYLVANIA, A SKILLED LABOR FORCE IS AT WORK PRODUCING QUALITY THREAD GENERATING EQUIPMENT FOR CUTTING, ROLLING, TAPPING AND GRINDING OPERATIONS.

May these people put their skills to work for you?

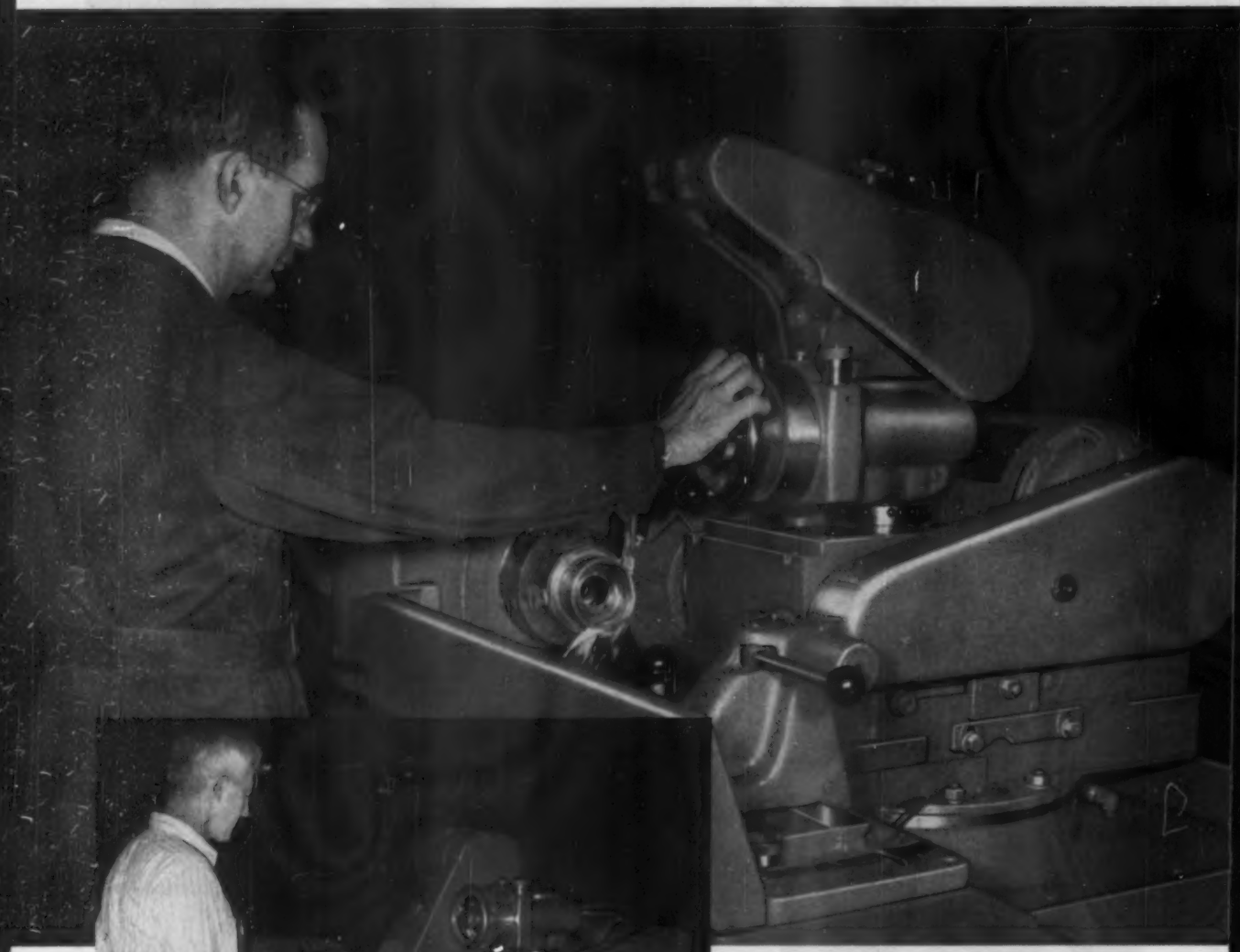
LANDIS *Machine* COMPANY

WAYNESBORO, PENNSYLVANIA

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

580C

Landis Precision Universals save time



Infeed grinding a workpiece held in a chuck on a Landis 10" x 20" Universal. *Left:* Internal grinding on this same size Universal.

Exclusive Landis features such as eye-level wheel feed, simplified operating controls, variable voltage headstock and spring loaded swivel save set-up time to give you more grinding time.

on all these grinding jobs

Grinding operations that can be done on Landis Universals

O. D. Center Grinding

traverse

infeed

traverse & shoulder

taper

diameter & face

O. D. and I. D. Chucking

infeed

taper

internal

internal taper

diameter & face

face

with extra equipment

face magnetic chuck

radius radial dresser

chucking-collets

diameter & face RH wheel mount

You can select a Landis of the proper size and power for your plant from the world's largest line of Universal Grinders.

Specifications

of Landis Hydraulic Universal Grinders

swing and type	lengths between centers	wheel drive motor—HP
10" Type H	20"-24"	1
10" Type CH	24"	1½
12" Type CH	36"-48"	3
14"-18" Type CH	36"-48"-72"	5
30"-36"-48" Type CHW	48"-72"-96"	7½

MMT PE

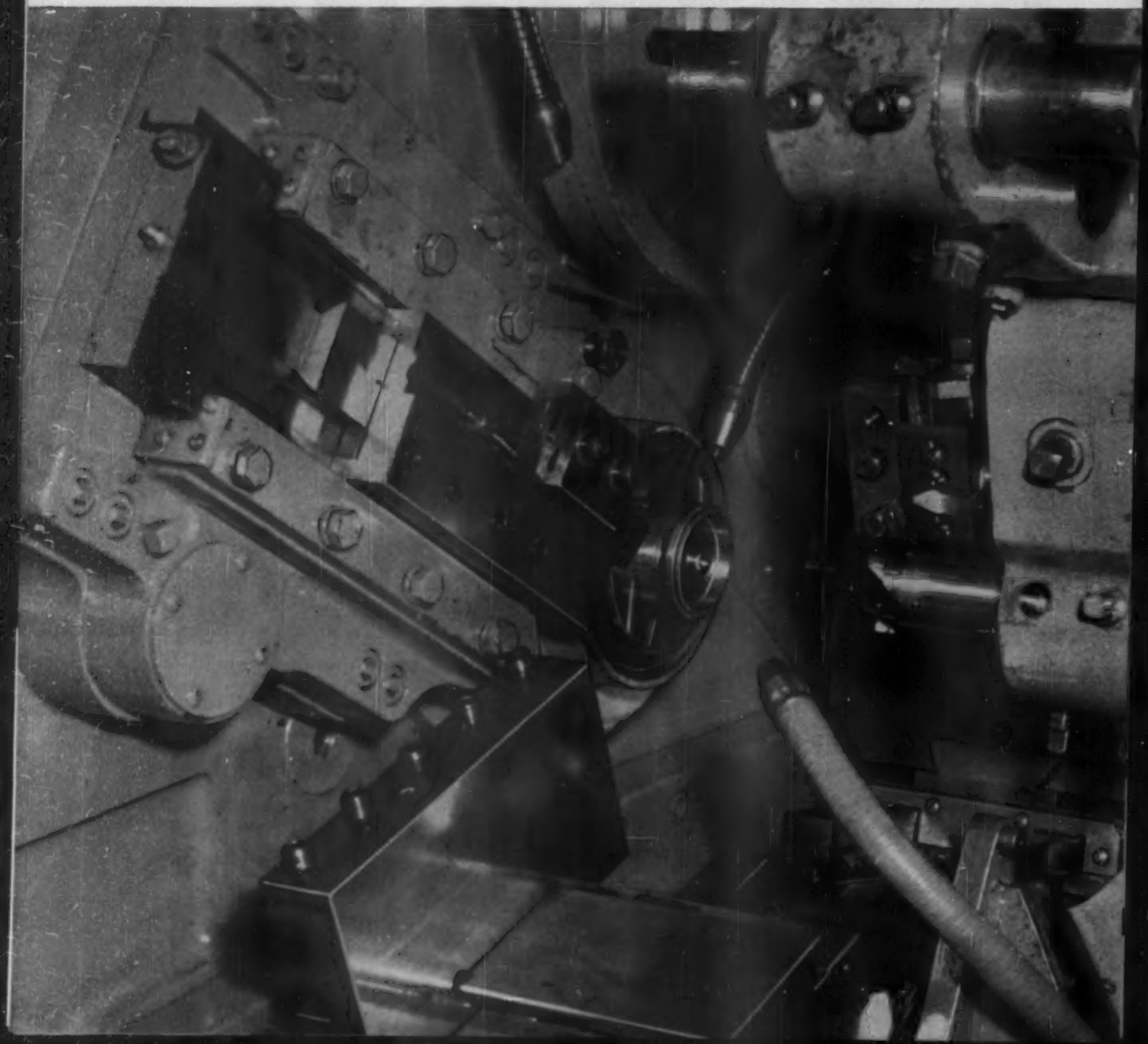
LANDIS

precision grinders

LANDIS TOOL COMPANY
WAYNESBORO, PENNSYLVANIA

AIRCRAFT JOBBING ON A BAR AUTOMATIC

Dearborn Manufacturing Co., Detroit, Michigan, manufacturers of precision parts and products, uses a 3-inch capacity Warner & Swasey 2AB Single Spindle Bar Automatic for small lot precision blanking of stainless steel parts used in aircraft and missile navigational equipment. Production up two to three times over former methods.



Three major factors led DEARBORN MFG. CO. to select the Warner & Swasey 2AB Single Spindle Automatic Bar Machine:

1. To be able to produce precision blanks with minimum stock allowance for secondary operations. Precision in this case means tolerances to .001 on diameters; .002 on lengths; concentricities to .001 T.I.R. Blanking to these close tolerances reduces the number of secondary chuckings required and eliminates heat distortion problems which occur when excess stock is removed rapidly in finishing operations.
2. Dearborn's major customers also use modern Warner & Swasey 2AB's and 2AC's. When subcontracting, their tools are sent to Dearborn where tooling interchangeability assures identical quality and maintenance of production schedules.
3. The 2AB Bar Automatic can be quickly and easily converted to chucking work thus providing greater flexibility to meet customers' production schedules.

The 2AB easily holds total tolerances of .001 with single point tooling. On many jobs secondary precision boring and centerless grinding operations have been eliminated. Warner & Swasey's exclusive camless design enables Dearborn to make frequent setups quickly, and obtain automatic production rates on lot sizes as few as 100 pieces.

Installed at Dearborn "back to back" with a Warner & Swasey 2AC Automatic Chucker, one operator usually handles both machines, thus splitting the direct labor costs. Tool interchangeability between the bar and chucking machines keeps inventory of standard tools down. And because of their unusual versatility, special tool costs are also minimized.

Why not call in your Warner & Swasey Field Engineer for more facts on how the 2AB can help you handle a wider range of jobs—short, medium or long run—at a better profit to you. Warner & Swasey Co., Cleveland 3, Ohio.

Typical part blanked-out on the 2AB. This first operation is completed in 3½ minutes compared to previous time of 7 minutes. Second chucking is on 2AC. Fourteen additional operations are required before this synchrostator housing is complete.

● Examples of workpiece variety handled on the 2AB at Dearborn.

You can produce it better,
faster, for less . . . with a

WARNER & SWASEY

CIRCLE 164 READER SERVICE CARD

FIRST IN TOOL ROOM LABORATORY AND DEVELOPMENT WORK

"THE OUTSTANDING TOOL ROOM LATHE" FOR CLOSE TOLERANCE AND FINE FINISH

HARDINGE
MODEL HLV
TOOL ROOM LATHE

WRITE FOR BULLETIN HLV

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

OFFICES IN PRINCIPAL CITIES. Export Office: 269 Lafayette Street, New York, N. Y.

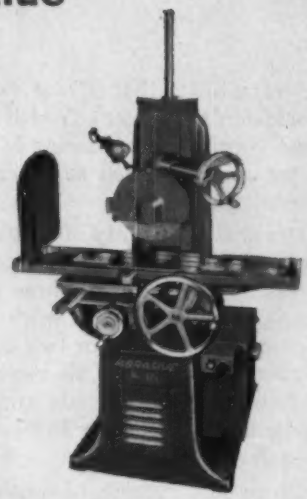
the ABRASIVE line

of precision surface grinders
first for accuracy... first for value

MMT PE

HYDRABRASIVE

The modern line of hydraulically operated surface grinders for general machine shops, production operations and tool shops. Four sizes with 12" wheel and 3 hp motor.

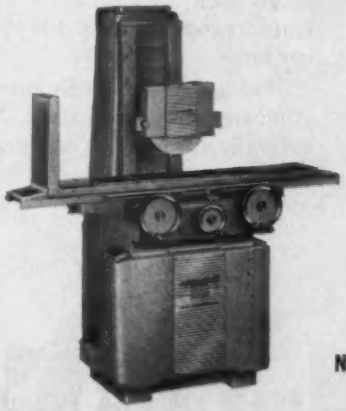


No. 1½

This is probably the most popular machine for tool and die work. Hand operated with a 12" wheel for deep slot grinding, 1 hp motor and 10" x 15" x 12" size.

No. M3 and 3B

For production and toolroom jobs where a fast, accurate surface grinder is needed with power table traverse and cross feed. M3 has 2 hp motorized spindle. 3B has 3 hp main drive with belt to spindle. Both 8" x 24" x 12" capacity with 10" wheel.



No. 618

One of the newest and most modern machines of its size for easy hand operation and dependable precision results. It's available with either a 7" wheel and 1 hp motor, or a 12" wheel with 2 hp motor.

ABRASIVE
precision surface grinders

a product of
LANDIS TOOL
world's largest manufacturer of precision grinding machinery
WAYNESBORO, PENNSYLVANIA

Precision and Versatility for Short Runs

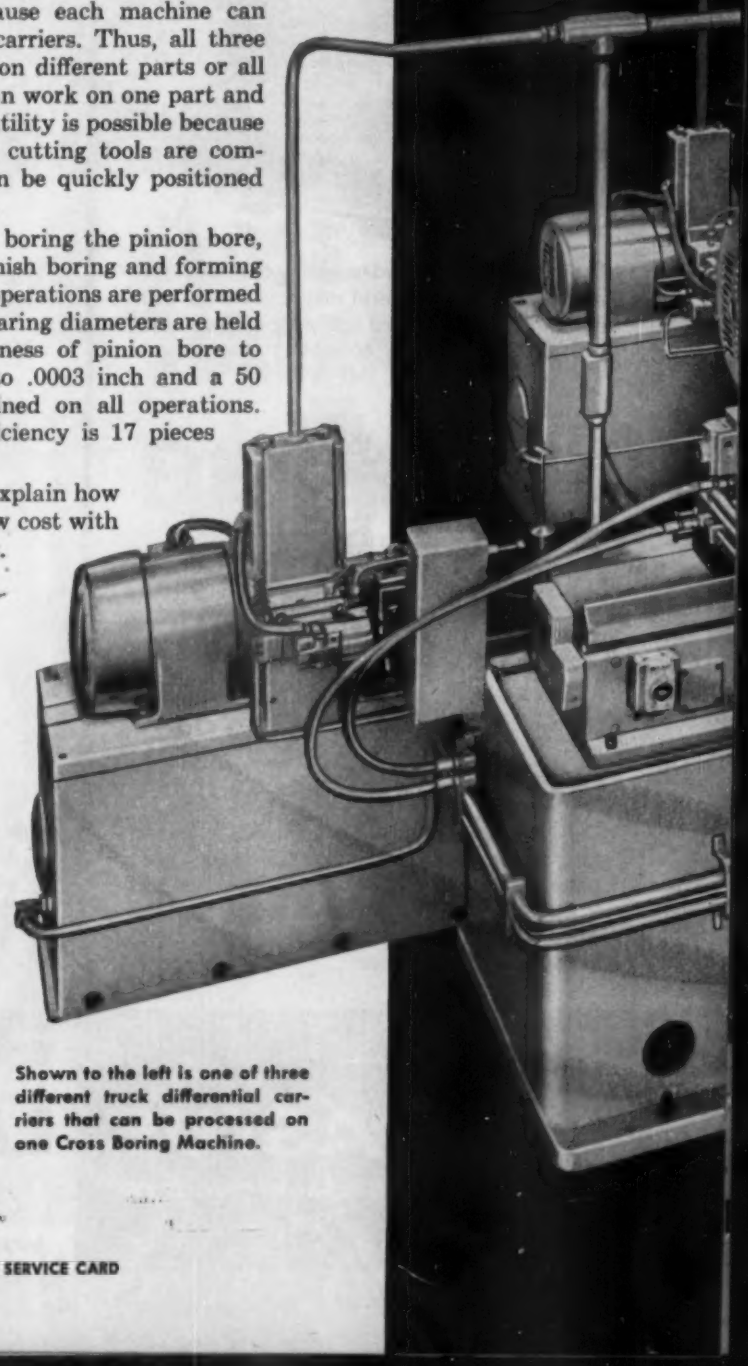
New Cross Precision Boring Machine for Differential Carriers

The versatility that Cross engineers can build into automation equipment is well illustrated by this new Three-Way Precision Boring Machine. It is one of three similar units designed to process three different truck differential carriers.

Unusual flexibility for variations in production requirements is provided because each machine can process any one of the three carriers. Thus, all three pieces of equipment can work on different parts or all can work on one part or two can work on one part and the third on another. This versatility is possible because the fixtures, boring heads and cutting tools are completely interchangeable and can be quickly positioned for each carrier.

Processing consists of finish boring the pinion bore, finish facing the pinion boss, finish boring and forming grooves in the cross bores. The operations are performed to a high degree of precision. Bearing diameters are held to less than .001 inch, squareness of pinion bore to pinion mounting face is held to .0003 inch and a 50 micro inch rms finish is obtained on all operations. Rated production at 100% efficiency is 17 pieces per hour.

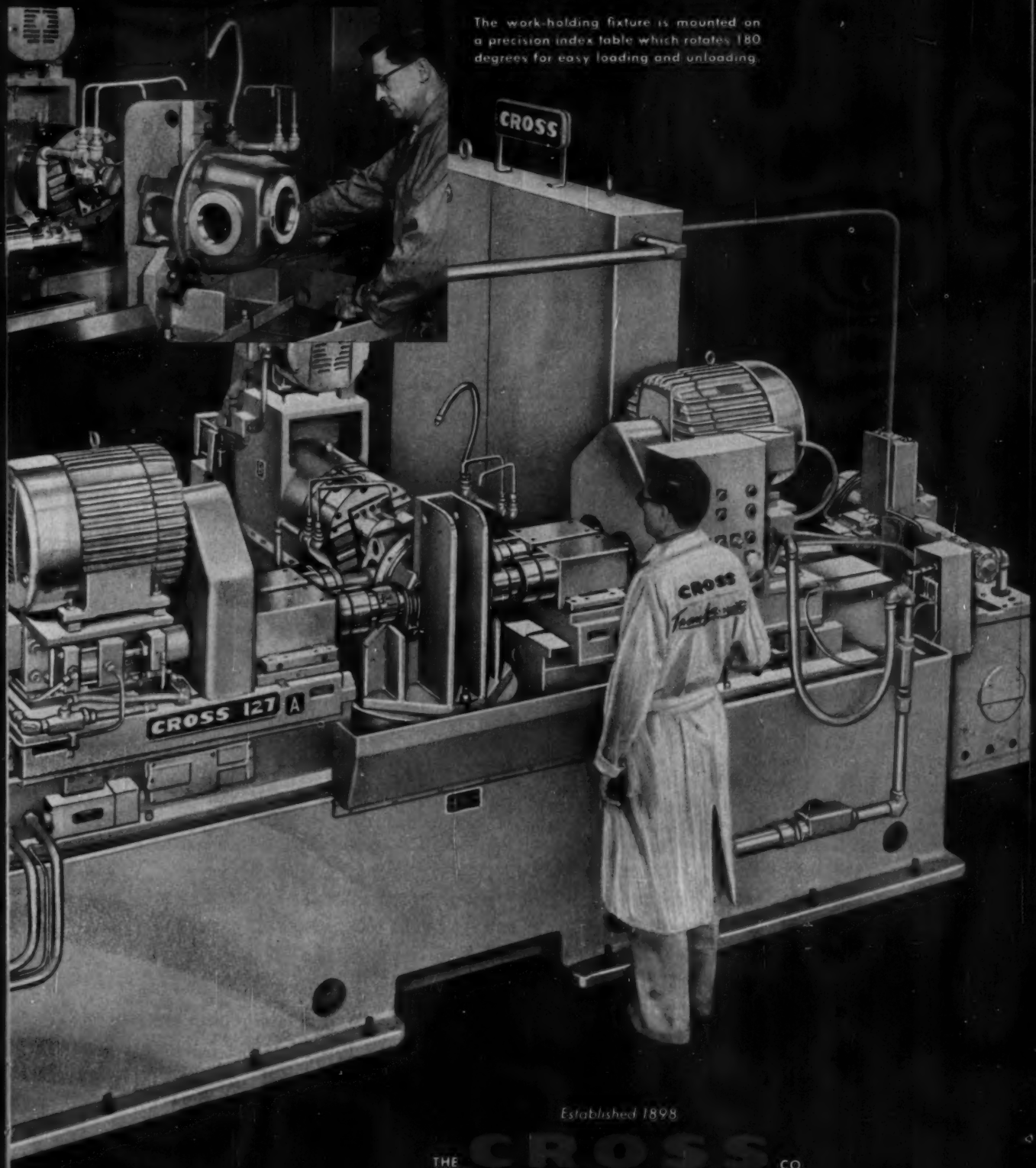
Let a Cross Sales Engineer explain how you can do precision work at low cost with versatile automation equipment.



Shown to the left is one of three different truck differential carriers that can be processed on one Cross Boring Machine.

CIRCLE 167 READER SERVICE CARD

Another Automation First by Cross



The work-holding fixture is mounted on a precision index table which rotates 180 degrees for easy loading and unloading.

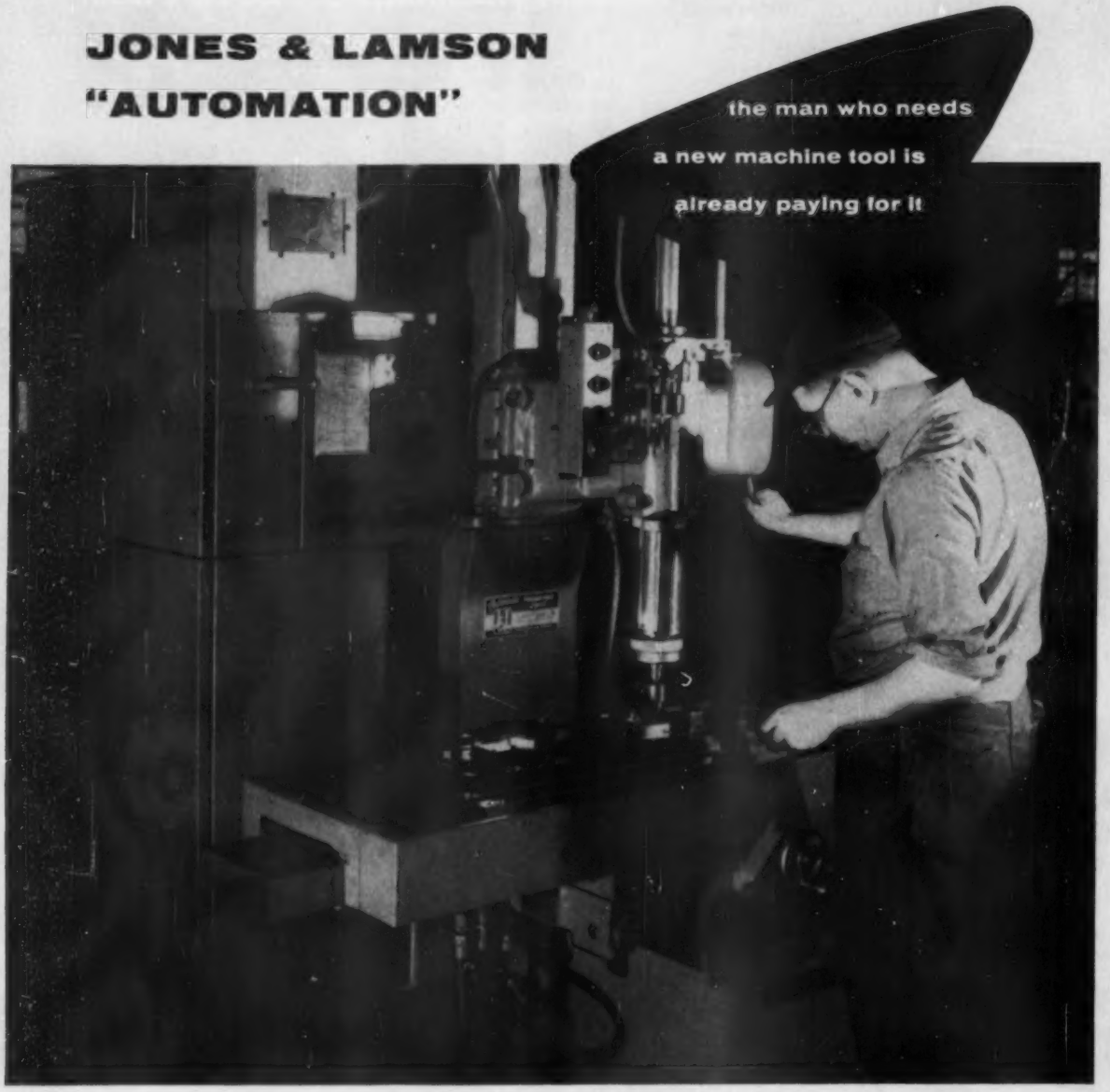
Established 1898

THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

JONES & LAMSON "AUTOMATION"



Major savings on every job during first full year of tape control operation

At The Goss Company, a division of Miehle-Goss-Dexter, Inc., Chicago, tape control machining plays an important part in the over-all production operation.

For instance, this J & L tape-controlled positioning table, equipped with a standard column drill press, has achieved an average of 30 to 40% savings in floor-to-floor time on every job assigned. One job, involving drilling and reaming of small malleable iron transfer roll adjusting plates, was transferred from a conventional sensitive drill press setup to the J & L machine. Job lots consisted of only four pieces.

The old setup required 3.1 hours production time for each lot. Using tape control, with a simple locating and clamping setup, Goss has been able to cut this time to 1.7 hours—a saving of 1.4 hours per lot, or more than 45%. Hole location is more accurate too, because J & L tape control consistently holds tolerances of + or — .001". With the old setup, it was difficult to hold hole locations to less than .010" on layout jobs of this size.

Investigate how *production-proven* tape control units can help increase the efficiency of *your* operation. Write to Jones & Lamson Machine Company, 502 Clinton Street, Springfield, Vermont for folder 5902, "Tape Control Positioning".

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

the complete line Skillfully made Butterfield spiral point taps cut smoothly and accurately, producing more components through longer service life. So it is with all other cutting tools in *the* complete line: hand taps, drills, reamers, dies, counterbores, cutters, end mills, hobs and carbide tools. Phone for quick deliveries or technical aid. Warehouses in Chicago, Detroit, Fort Worth, Los Angeles, New York and San Francisco. **Call your Butterfield Distributor.**

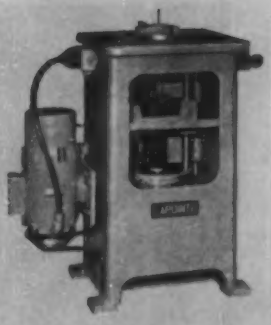
BUTTERFIELD

DIVISION, Union Twist Drill Company, Derby Line, Vt.

A PRODUCT OF SKILL

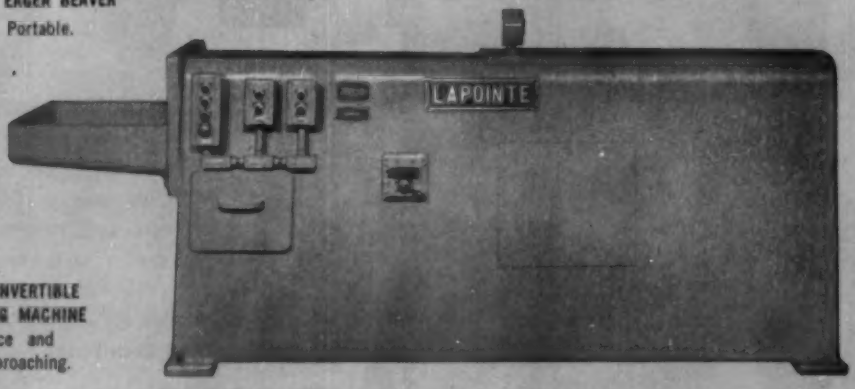
36B.0.6

A challenge to the fellow



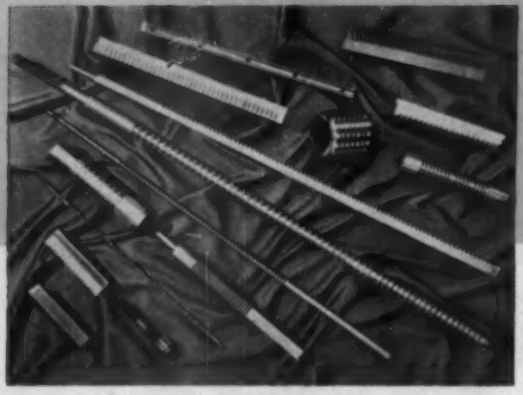
EB . . .
EAGER BEAVER
Portable.

Do you know that some Lapointe Broaching machines were developed specifically for use in the toolroom and in job shops? The three small machines shown here have versatility and flexibility, and are representative of the ultimate in Lapointe quality, yet low in price.



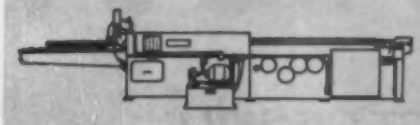
HP5 BROACHING MACHINE Available in two strokes: 30" and 48"

SMALL CONVERTIBLE BROACHING MACHINE
For surface and internal broaching.

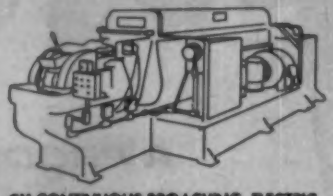


Do you know that Lapointe Broaches are made of special alloys to our own formula, and quality-controlled throughout every detail of their manufacture and metallurgical treatment in our plant?

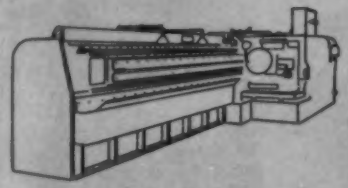
Lapointe-built Broaching Machines are available in hydraulic and electro-mechanical drives.



60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC



SRHE SINGLE RAM HORIZONTAL, ELECTRIC

who "knows all about broaching"!

Do you know that wherever LAPOINTE **-BROACHING** can be used, it offers you the *greatest potential for cost reduction* of any metal-removal method?

Do you know that some operations can *only* be performed by broaching?

Do you know that Lapointe-Broaching eliminates scrap — even on operations involving dimensional accuracy to extremely close tolerances, and requiring fine micro-finish? That's because all of the machining skill is embodied in the broaching tool itself, thus removing the human factor in generating difficult contours.

Do you know that Lapointe is the oldest and largest company in the broaching field, with nearly 60 years of experience building broaching equipment exclusively?

Do you know that Lapointe pioneered most of the major developments in the art of broaching?

Do you know that many manufacturers rely on Lapointe for all their broaching needs? That's because Lapointe will take full responsibility for the entire broaching operation . . . we build the broaching machines, the fixtures, and the broaching tools.

***Do you know** that this emblem refers to the National Machine Tool Builders Association's big Machine Tool Exposition to be held at the International Amphitheatre in Chicago, September 6–16, 1960 . . . and that Lapointe-Broaching will be impressively represented by a working exhibit of broaching machines, fixtures and tools in full operation?*

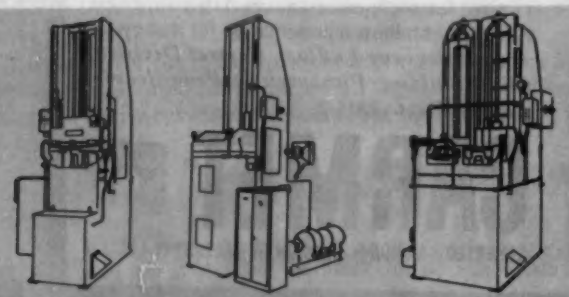
MODERN MACHINE TOOLS — MMT-PE — PRODUCTION EFFICIENCY

It will be to your advantage to attend this important Machine Tool Show, and see Lapointe-Broaching in the new Donovan Hall, Space No. 1229.

THE LAPOINTE MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES



VUE-7 VERTICAL PULL-UP ELECTRIC — SRVE SINGLE RAM VERTICAL, ELECTRIC — DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

known to be the best in

BROACHING

Got a severe WEAR problem? Your answers are in this booklet

This new booklet is crammed with information on Carmet Cemented Carbides . . . man's hardest, most abrasion resistant metal . . . and on design techniques that make the most of Carmet's unique properties.

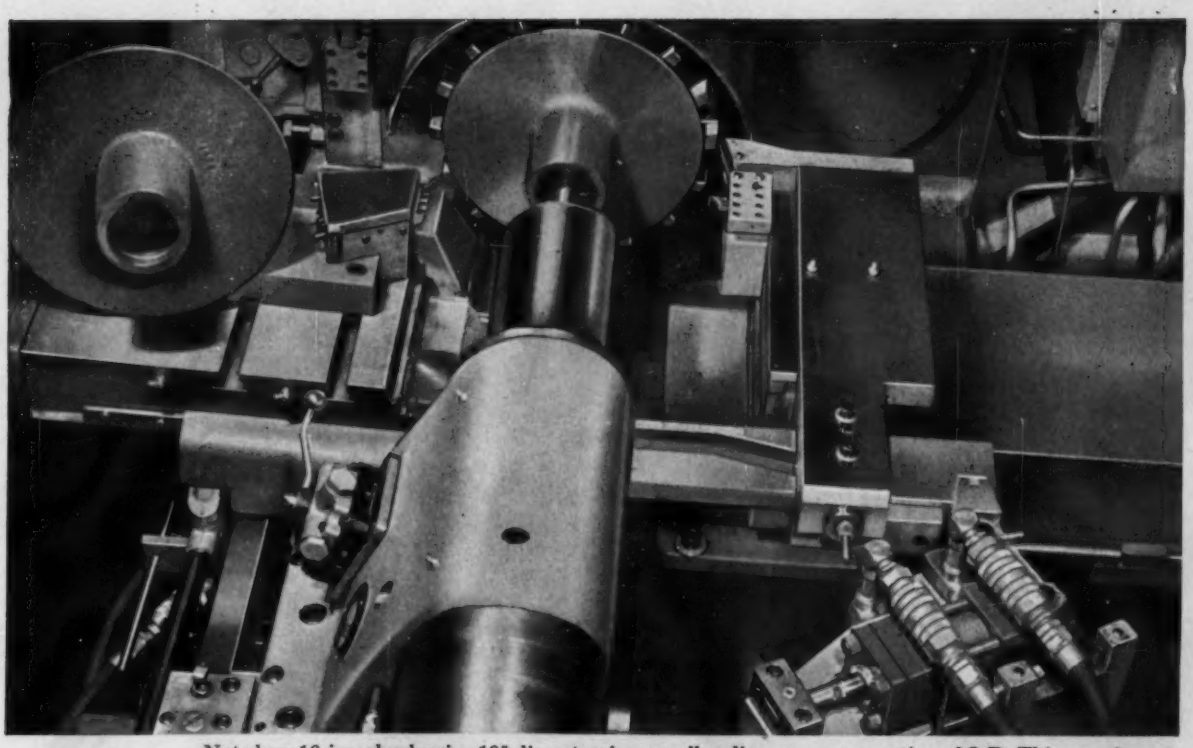
Properly designed, Carmet Cemented Carbides give outstanding service in applications involving severe wear and abuse. They possess an extraordinary combination of extreme hardness and strength, higher than any metal or alloy . . . cast, rolled or forged. They have three times the stiffness of steel . . . up to 100 times the abrasion resistance.

In Carmet's new booklet, the designer will find the charts, graphs, case histories, and tables of information needed for intelligent selection and application of the Carmet Cemented Carbides. And, there's a special section on design criteria for top performance. Ask your local Allegheny Ludlum representative for a copy, or write: *Allegheny Ludlum, Carmet Division, Oliver Building, Pittsburgh 22, Pennsylvania. Address Dept. AM6-2.*

CARMET®

CEMENTED CARBIDE • DIVISION OF ALLEGHENY LUDLUM

2006



Note how 16-jaw chuck grips 10″-diameter, inner pulley disc on narrow portion of O.D. This permits machining entire flange face. Accurate taper is generated by cam-operated sliding toolholder shown at right.

No. 12 replaces two manual lathes, cuts time 53%

Automatic cycle, fast setup cut job-lot costs...free operator for other work.

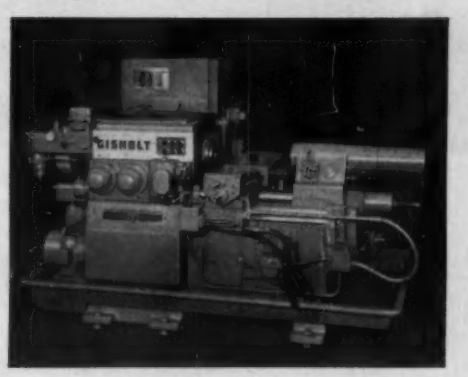
This fast, versatile setup may give you some new ideas on paring job-lot costs. Lewellen Manufacturing Company, Columbus, Indiana, uses it for machining three types of cast iron pulley discs in 15 sizes—in lots ranging from 50 to 100 pieces.

Previously this work required two manually operated lathes. Now one operator does the entire job 53% faster on one Gisholt No. 12 MASTERLINE Automatic Chucking Lathe.

Here's how a typical inner pulley disc, 10″ in diameter, is handled: To permit machining beyond the tapered face, the work is held on a narrow portion of the previously turned O.D. in a 16-jaw chuck. A chuck-mounted mandrel with tailstock support provides rigidity for higher speeds and feeds.

Front carriage tools turn the hub O.D. within .0005″ and form the base radius. The flange is taper-faced from a cam-controlled sliding toolholder on the rear independent slide. A second tool faces the hub end. Time, just 2.2 minutes, f.t.f.

Change-over for different sizes averages less than 30 minutes. One 30° adjustable cam handles all tapers. Quick-disconnect fittings are easily reversed for tool relief when changing from inner to outer discs.



Gisholt MASTERLINE No. 12 Automatic Chucking Lathe

FOR COMPLETE INFORMATION

on how the No. 12 can cut your costs on job-lots and production runs, contact your Gisholt Representative—or write for new catalog, Form 1213.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • *Factory-Rebuilt Machines with New-Machine Guarantee.*

Investigate Gisholt's Extended Payment and Leasing Plans

IT PAYS TO STANDARDIZE ON STANSCREW

Stanscrew suggests... BRUNING verifies... Socket set screws solve *Copyflex* problem

Charles Bruning, Inc., manufacturers of the widely accepted Copyflex, recently found that the fasteners they were using to attach the unit's sprockets and gears did not meet the rigid performance standards they set up for all component parts.

Bruning's distributor arranged a visit from a Stanscrew specialist, who recommended Stanscrew's regular socket set screws. Bruning verified their operational efficiency with exhaustive laboratory and engineering tests . . . made the conversion . . . and eliminated the loosening problem (plus eliminating many service calls).

Now, 100 Stanscrew fasteners are specified for each Model 675 Copyflex. In addition to socket set screws, they include socket head, hex head, and fillister head cap screws which are used in a wide variety of critical applications.

Like Bruning, more and more industrial leaders are learning it pays to standardize on Stanscrew. Their more than 5,500 different standard fasteners provide economical answers to the overwhelming majority of all industrial requirements . . . and are produced to consistent quality standards which eliminate production problems and lower assembly costs.

The Stanscrew fastener specialist may be able to help you cut fastener costs. Your Stanscrew distributor will be happy to arrange a prompt visit. Call him today.

STANSCREW FASTENERS

CHICAGO | THE CHICAGO SCREW COMPANY, BELLWOOD, ILLINOIS
HMS | HARTFORD MACHINE SCREW COMPANY, HARTFORD, CONNECTICUT
WESTERN | THE WESTERN AUTOMATIC MACHINE SCREW COMPANY, ELYRIA, OHIO

STANDARD SCREW COMPANY 2701 Washington Boulevard, Bellwood, Illinois

CIRCLE 175 READER SERVICE CARD
CIRCLE 176 READER SERVICE CARD ►

ANOTHER NORTON PRODUCT

the New VIZI-DISC

lets you see your work while you grind. It cuts cooler and gives you pin-point accuracy

The unique shape of the METALITE VIZI-DISC gives it "see-through" like a fan blade or an airplane propeller. The operator can see right through the work area of the disc. Obviously, the intermittent action means cooler operation. Get a free demonstration of VIZI-DISC. Just call your Behr-Manning representative or write Dept. AM-6, BEHR-MANNING CO., TROY, N. Y., A DIVISION OF NORTON COMPANY.

BEAR BRAND Coated Abrasives

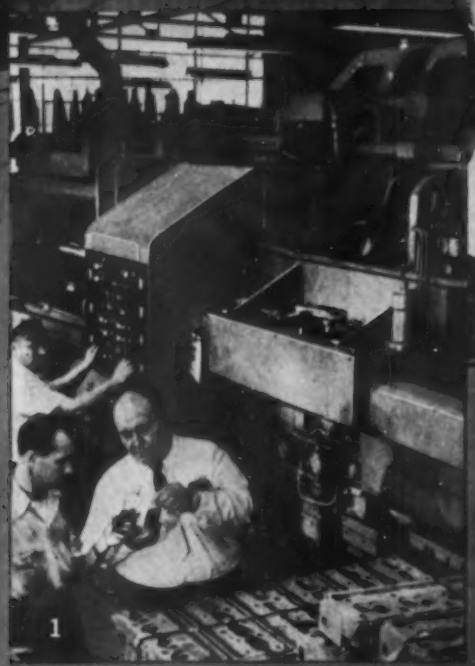
Here is the VIZI-DISC mounted on a portable electric grinder, ready to run. Note the unique shape with parallel sides.

As the grinder starts, note the spinning pattern, similar to an airplane propeller or the blade of an electric fan.

Full rpm. With the VIZI-DISC there is no blind spot. You see your work while you work, as the grinder gets revved up.

HOW
MOBIL
HELPS

American Motors set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2

"The popular demand for Rambler Automobiles has resulted in sharply increased production requirements for our division. To keep our equipment running at capacity we have worked closely with Mobil Oil Company. This effort has been completely justified and has saved us considerable money."

MR. R. E. ANDERSON, *Superintendent, Motor Division, American Motors Corp.*

production records!

American Motors Plant at Kenosha, Wisconsin, fills increased production demands... reduces downtime... cuts labor and material costs!

Keep 'em coming! That's the order of the day for Rambler Automobiles, and production stoppages can be disastrous. When American Motors' far-sighted management anticipated production demands that would greatly exceed rated plant capacity, they promptly went about making preparations. Mobil was called in to insure correct lubrication for the highly critical production machinery in the motor division.

Mobil engineers, working in close cooperation with American Motors personnel, analyzed the lubrication problems posed by this record output . . . studied other problem areas as well. They recommended correct heavy-duty products, effective preventive maintenance procedures, techniques to reduce contamination and prolong lubricant life. As a result, machine downtime was greatly reduced, production availability sharply increased, and direct dollar savings to American Motors were achieved.

If you are interested in how Mobil may help you solve lubrication problems in your plant, call your nearest Mobil representative. Or write: Mobil Oil Company, 150 East 42nd Street, New York 17, New York.

1. An annual change of hydraulic oil was once the rule for this large machine which broaches top and bottom of cylinder heads. Mobil engineers felt oil usage could be extended, performed periodic analyses that showed oil could be used three years. Examining oil sample is Anthony Belasich, Assistant Superintendent.

2. This "transfer line" machines cylinder heads. Subsequent washing operations were hampered by excessive "soaping" of the cleaner. Mobil traced the trouble to the cutting oil then in use . . . recommended an equally effective, but less costly product that solved the problem.

3. To meet production schedules, American Motors runs its engine division 24 hours a day at full capacity. Overload caused frequent breakdowns on the critical transfer machines that drill and ream 6-cylinder blocks. Mobil recommended a correct heavy-duty lubricant, suggested periodic filtering of lubricant and hydraulic oil. Stoppages were drastically reduced. Discussing filtering procedure are Rudy Naiberg, Assistant Superintendent and Frank Zuerner, Mobil Representative.

Mobil

CORRECT LUBRICATION

MOBIL OIL COMPANY, 150 East 42nd Street, New York 17, N. Y.

CIRCLE 178 READER SERVICE CARD

CONSISTENT

MACHINABILITY!

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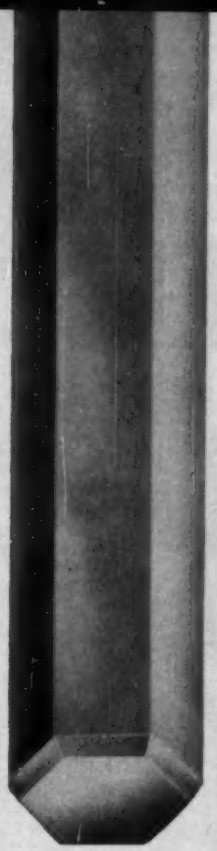


Every rod... every bar of new Kaiser Aluminum Micro-Chip 2011-T3 delivers consistently superior machining, not only from lot to lot but throughout every length. It can help you set new records in production speed and quality control. Here's how:

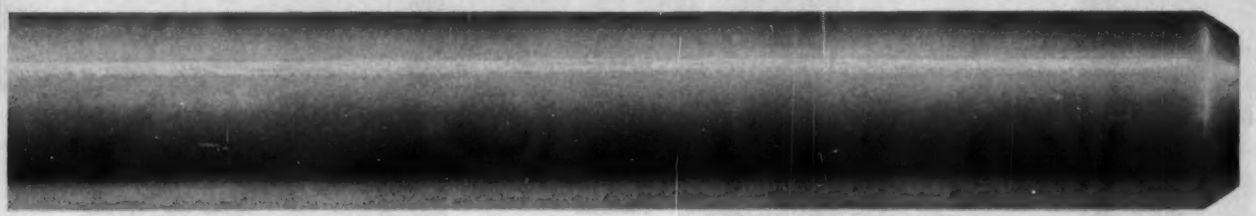
1 LESS RESETTING OF TOOLS—The new Kaiser Aluminum Micro-Chip process makes Micro-Chip uniform in machining characteristics. Consistent machinability means less resetting of tools... less down time... and lower unit costs.

2 FASTER MACHINING—Micro-Chip turns out finer, smaller chips... increases machining surface speeds as much as 40% over other standard screw machine alloys. Micro-Chip produces a maximum number of parts with minimum tool wear.

3 BRIGHTER, CLEANER SURFACE—Micro-Chip stock is delivered cleaner and brighter. Even portions not machined have a quality finish without special handling.

4 BOTH ENDS CHAMFERED†—Chamfering at both ends of Micro-Chip rod and bar eliminates awkward work of reversing metal for entry into machine—reduces feed finger wear.

†From ½" to 2" inclusive.



NOW—MICRO-CHIP IS IN STOCK EVERYWHERE! CALL YOUR KAISER ALUMINUM DISTRIBUTOR • Kaiser Aluminum Micro-Chip is now available for immediate delivery through Kaiser Aluminum Distributors or your Kaiser Representative. Micro-Chip comes in 12-foot lengths, up to 3-inch diameter and 2-inch hex in standard 200-pound packages—at **no increase in price** over regular 2011-T3. Ask for "Micro-Chip" and look for the label.

KAISER ALUMINUM & CHEMICAL SALES, INC.
Kaiser Center, 300 Lakeside Drive, Oakland 12, California
See "MAVERICK" • Sunday Evenings, ABC-TV Network • Consult your local listing

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MICRO-CHIP

2011-T3

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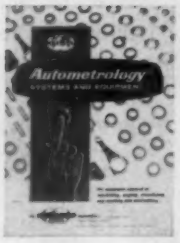

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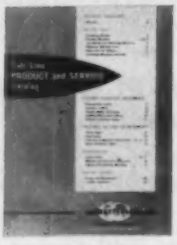

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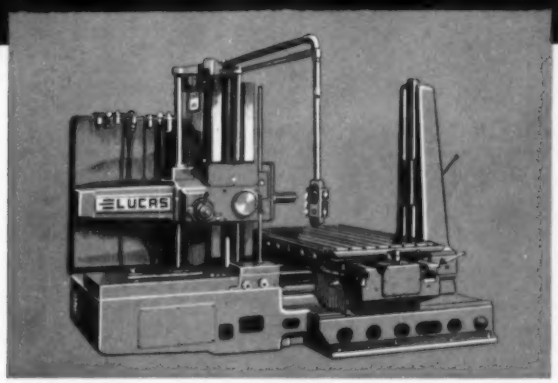
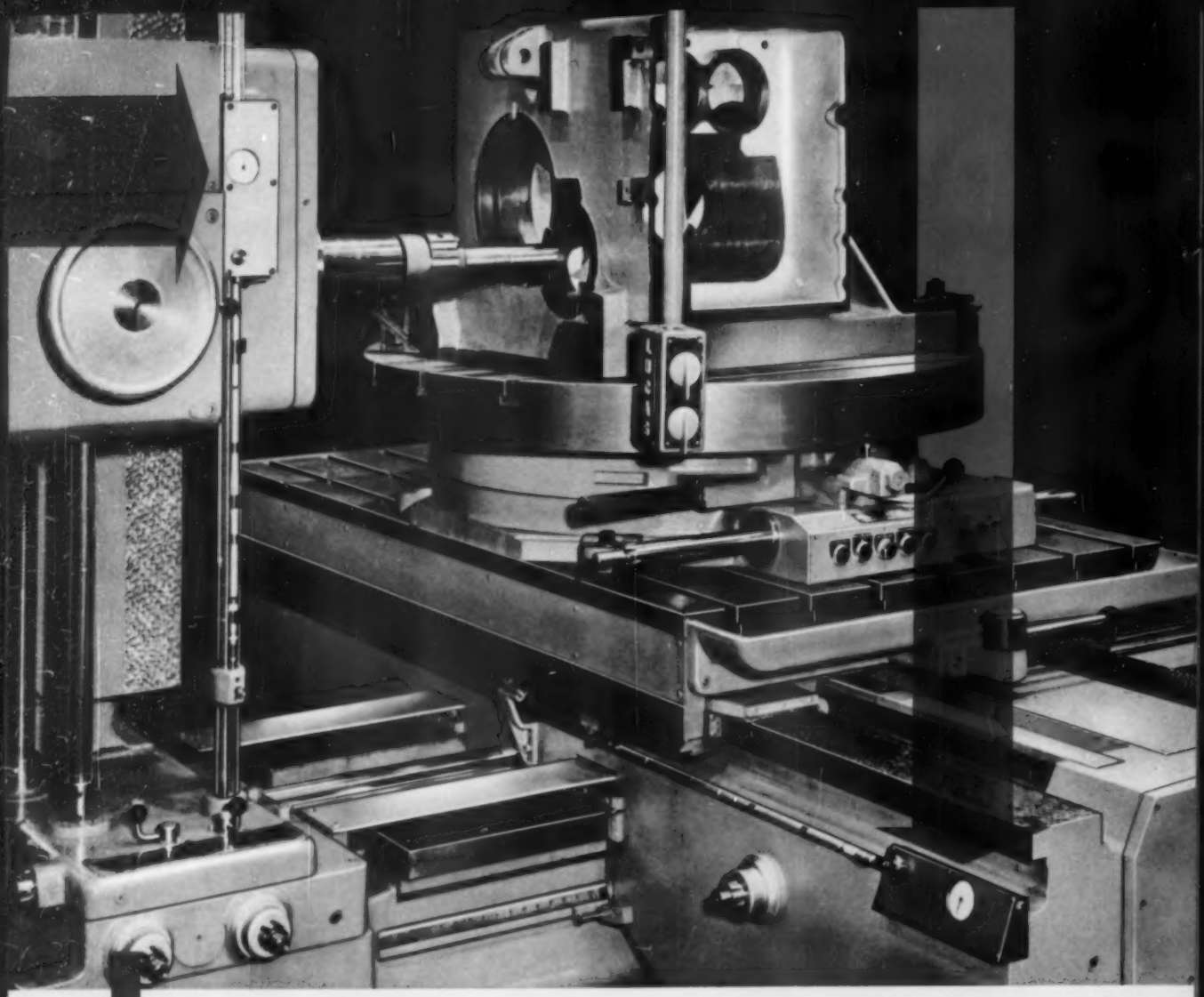


Automatic power positioning with Lucas precision

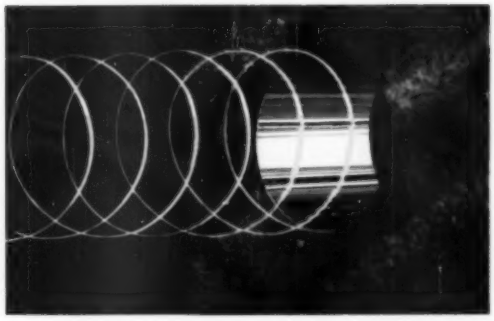
For production or faster completion of a single piece: locates head and table to predetermined settings for boring operations. No time wasted on jigs or fixtures in drilling, reaming and tapping. Lucas versatility, precision and time saving are the keys to Lucas profitability. Lucas Machine Division, The New Britain Machine Company, Cleveland, Ohio.

LUCAS
OF CLEVELAND



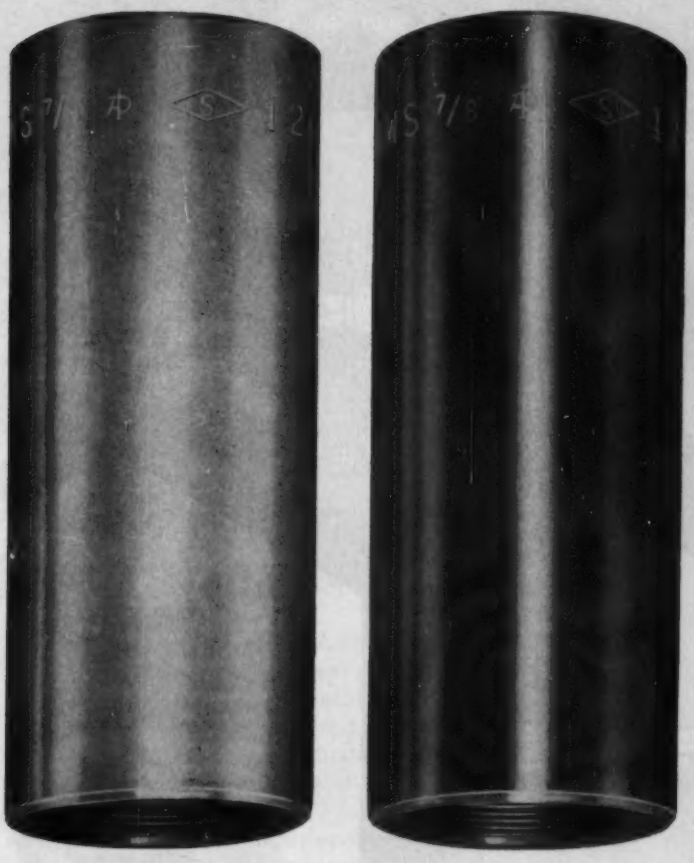
Automatic repeat settings accurate to ± .0001

Lucas Automatic Power Positioning operates at rapid traverse to locate head and table, entirely independent of operating feed rates—thru a system of end measuring rods and micrometer dial indicators. Upon starting the positioning cycle the machine does the precision setting automatically. Would you like a complete Lucas Catalog? Lucas Machine Division, The New Britain Machine Company, Cleveland, Ohio.



LUCAS
OF CLEVELAND

"Oilwell" Sucker-rod couplings machined from leaded alloy steel at high cutting speeds and finished on a centerless grinder. Couplings are shown *before* and *after* heat treatment.



USS leaded Alloy Steel bars speed up machining...produce a superior finish.

This sucker-rod coupling is a good illustration of how **leaded** alloy steel in the annealed condition can increase machining speeds, produce more parts per hour, and assure an exceptionally fine finish. Cutting tools don't have to be changed as often, threads are smoother and the ends machine accurately. ☐ The steel used in the coupling is leaded, an Open Hearth, Ni-Mo Leaded Steel. Cutting speeds of 268 to 313 r.p.m. were used with an .007″ feed producing 550 to 900 couplings before having to change cutting tools. Other users have reported production increases of about one-third over unleaded alloy steel. ☐ If you are looking for a superior product, we urge you to try USS Constructional Alloy Steels, such as 4140, 4145 or 8620 with lead. In addition to good machining, you get high resistance to abrasion and corrosion, better finish and longer product life. ☐ You can obtain USS Leaded Alloy Steel bars and semi-finished steel in all the usual sizes of rounds, squares, hexagons and flats. If the leaded alloy grade you need is not listed here, write or call the nearest office of United States Steel or write to United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

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USS

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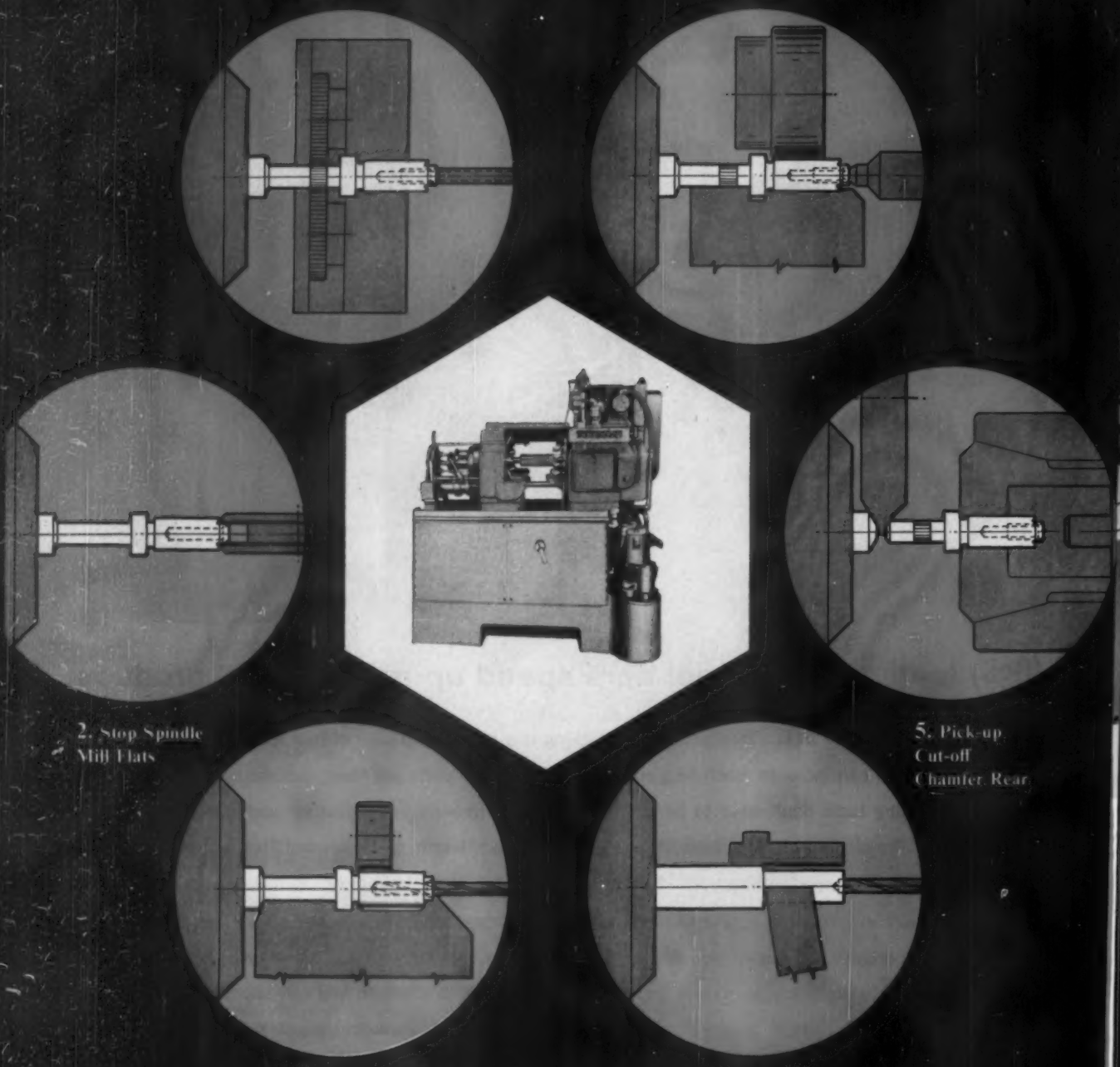

9 operations in 3.8 seconds . . . one of the typical parts produced by Keystone Mfg. Co. on the 7/8" RA-6 Bar Automatic

85,000 Pieces Per Day And No Rejects

Production *facts* tell a typically impressive story of Acme-Gridley machining efficiency at Keystone Manufacturing Company, Boston, Mass.

"We have five 3/16" RA-6 Spindle Bar Automatics", states a Keystone executive. "Everyday, they produce an average of 85,000 precision parts for our cameras and projectors . . . and yet, there are literally no rejects. As a result of this consistent conformance to our tough tolerances, scrap losses have been wiped out and inspection time reduced to an all time low. What's more, because Acme-Gridleys produce in a single set-up jobs otherwise requiring secondary machining, we've cut production costs."

Dramatic and *tangible* savings like those realized by Keystone are commonplace with Acme-Gridleys. Such features as a wide open tooling zone, direct camming and independently operated tool slides can help you achieve higher mass production efficiency at lower cost. We'll be happy to supply complete information on the world's most complete line of multiple and single-spindle automatic bar and chucking machines. Call, write or wire.

National Acme's "Zone of Responsibility" includes all phases of cost reduction
Check YOURS . . . Then Check National Acme

Direct Costs: these include direct dollar savings as realized by Keystone Manufacturing Co. . . . an "everyday" job for Acme-Gridleys. **Indirect Costs:** effecting important savings in maintenance, downtime, scrap reduction, tool costs, etc. **Product Redesign:** teaming with your design group to take full advantage of Acme-Gridleys' cost reducing capabilities. **Direct Material Costs:** our engineers provide important savings in this area by constantly matching machines and tools to modern metallurgical problems. **Make-or-Buy Reviews:** in many cases our Contract Division can assume your production headaches and relieve you of immediate capital investment. **Spot Modernization:** pioneering in modern tooling methods, and the flexibility of Acme-Gridleys can provide many "on-the-spot" savings.

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MMT-PE

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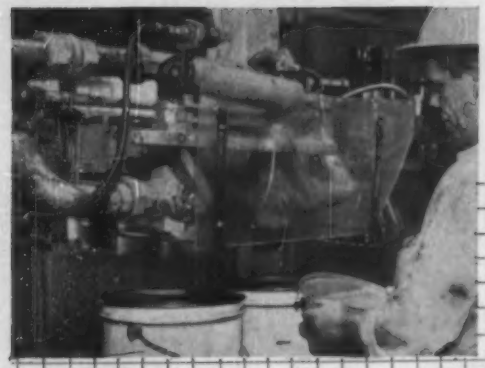
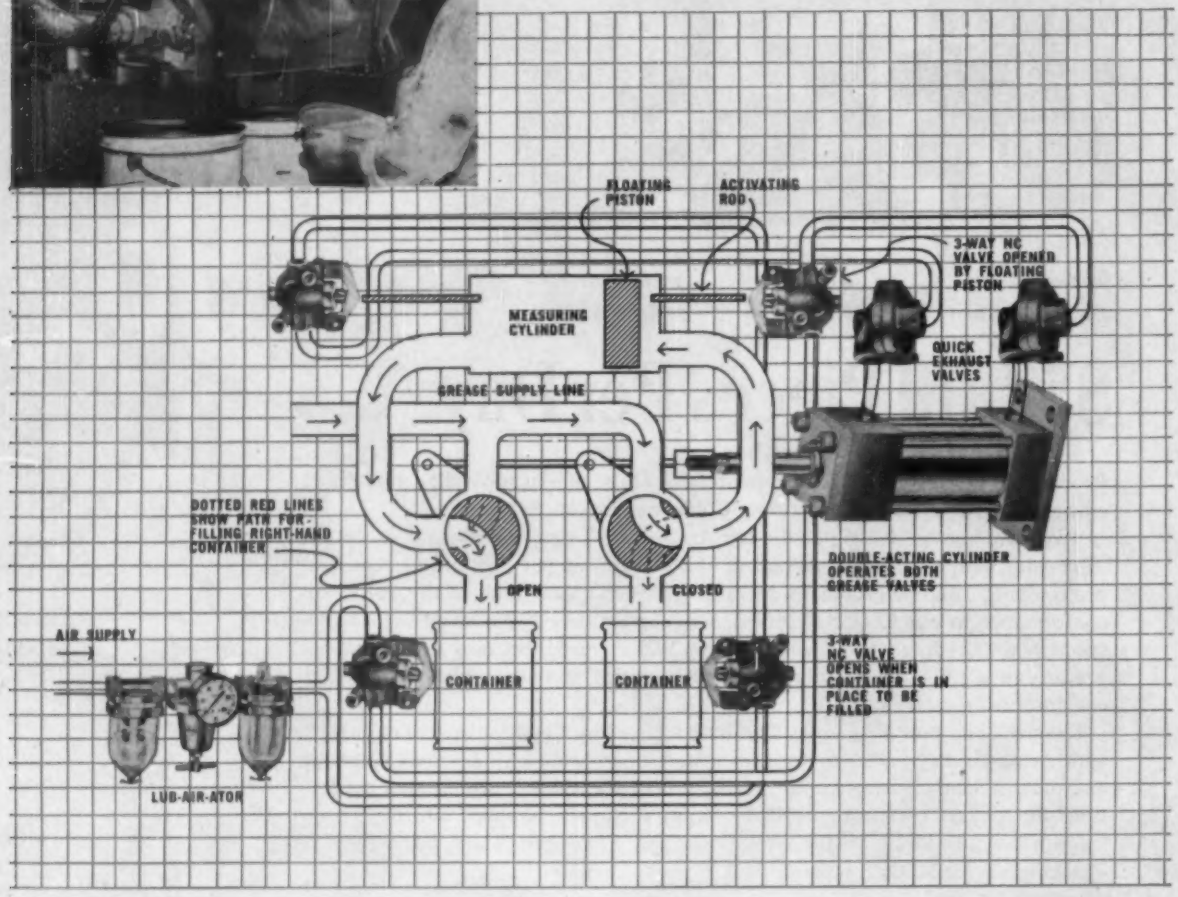


Here is an example of Schrader at work. Barrett Mfg. Co. of Houston, Texas, makes grease handling equipment for Mobil Oil's Brooklyn, N. Y., refinery. This machine fills 35 pound grease drums automatically accurately, 15 per minute! George Barrett, who designed and built this machine and other machines for Mobil, says: "My reputation for quality is too hard-won to risk by using some inferior line of air products."



PACKAGING EQUIPMENT MAKER DESIGNS MACHINES TO ORDER... AUTOMATES THEM 100% WITH SCHRADER AIR PRODUCTS

In limitless combinations, Schrader Air Products are performing thousands of jobs in thousands of plants. Wherever jobs are messy, tricky, heavy, monotonous or complicated—it pays to talk to Schrader.

Air is already available to you. Put it to work—on your own operations, or on the equipment you make for resale, like the company shown above. Just tick off its advantages: high speed and accuracy, low cost and maintenance—plus safety, simplicity, dependability. Air can do almost anything fingers can—and many things fingers can't.

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Select from the full Schrader lines to plan your automation of machines. Your Schrader distributor can help you pinpoint what you need. For more data, write:

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QUALITY AIR CONTROL PRODUCTS

POSITIVE DUPLICATION—EVERY TIME!

These "fingerprints" of a tree will always duplicate characteristics by which an expert can positively identify all cross-sections from the trunk of that tree.

But you don't have to be an expert to get Positive Duplication—when you use these CINCINNATI (PD)° SEGMENTS, and *all* CINCINNATI GRINDING WHEELS.

YOU GET (PD) UNIFORMITY

Cincinnati supplies you with wheels of uniform excellence, because of the unique (PD) manufacturing process which involves 36 separate and unvarying quality controls.

Every step, from grain mix to final inspection, is directed to uniformity of product. For example, while vitrified wheels are being fired, automatic recording analyzers keep sampling the kiln atmosphere to maintain desired oxygen content throughout the firing process.

RESULT: DEPENDABLE PERFORMANCE

You can *depend* on (PD) WHEELS because each reorder wheel gives you exactly the same good job as the original.

Using (PD) WHEELS you will find production going up, and costs going down . . . *to stay!* This is the promise —and the performance—of Positive Duplication.

CALL CINCINNATI TODAY

Solve your grinding problems with the help of specialists trained by the Cincinnati Milling Machine Company. Their wide experience in job set-ups and grinding operations is at your service.

Just call your CINCINNATI (PD) GRINDING WHEELS Distributor or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

(PD) POSITIVE DUPLICATION

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GRINDING WHEELS

°Trade Mark Reg. U.S. Pat. Off.

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

Courtesy North American Aviation, Inc.

North American Aviation gauges it right on a Gilbert

He's gauging a part for North American Aviation's F-100 modification program. Checking to see if it meets tolerances of plus .0005″ and minus .001″.

Not much doubt in his mind because he knows what his Cincinnati Gilbert radial can do when the tolerances get tight (and, as you know, they're getting tighter all the time).

Full spindle support near the tool contributes to accuracy. So does the balanced arm, which resists torsion, compression, and tension forces. And so do many other details which are described in our Bulletin 349.

Along with North American Aviation, you join a fine company of meticulous craftsmen when you acquire a Cincinnati Gilbert radial. Our representative will be happy to call at your earliest convenience.

The Cincinnati Gilbert Machine Tool Co., 3340 Beekman St., Cincinnati 23, Ohio.

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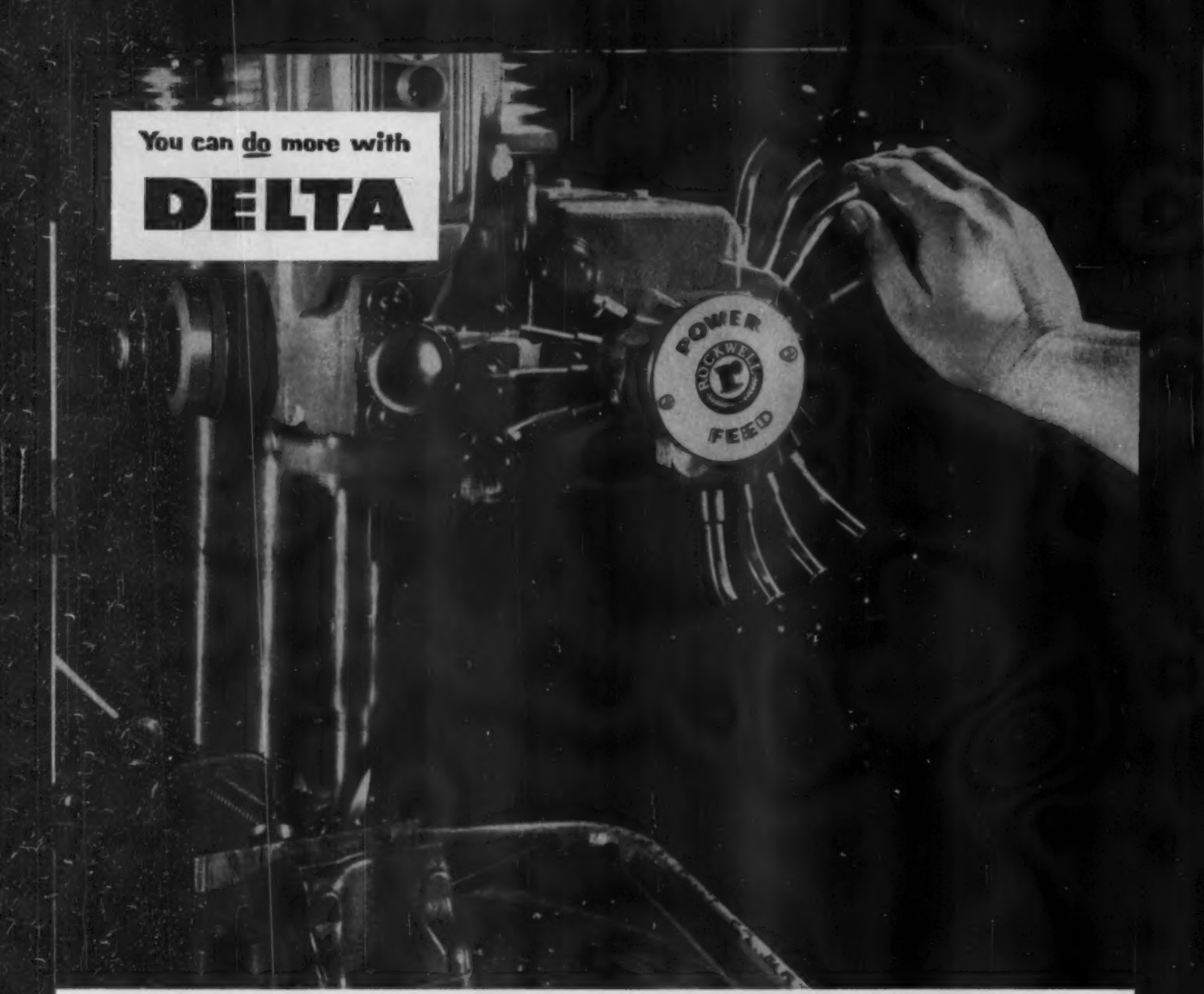


NEVER BEFORE—UP FRONT CONTROL WITH ONE HAND OPERATION

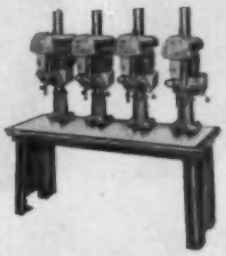
Unique pilot wheel control is mechanically integrated with the clutch control, allows operator to engage power feed with a simple wrist movement of one hand. Without any adjustments, operator can use rapid manual approach then power feed, skip drilling technique, straight power feed or straight manual feed. There are four feed ratios—.004, .006, .009 and .012 ipr—with each of five available spindle speeds.

NEVER BEFORE—SUCH A COMPLETE CHOICE OF MODELS

Floor model

Bench model

Overhead model

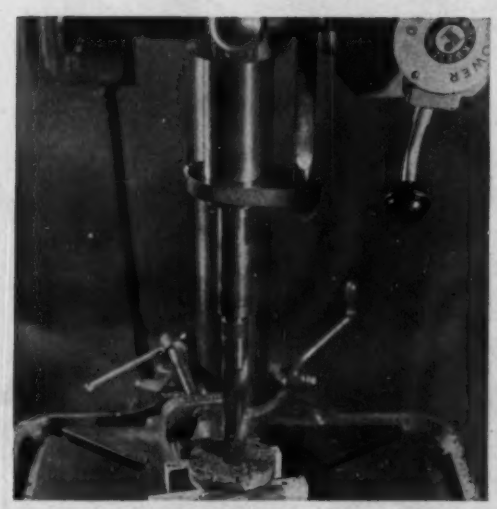


Multiple spindle model

ROCKWELL ANNOUNCES . . .

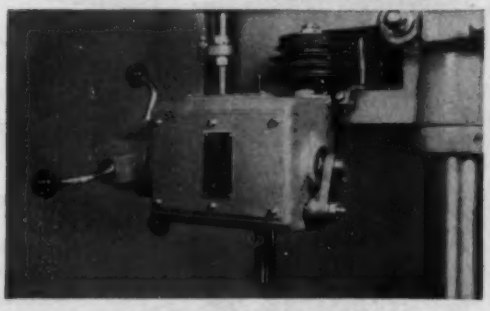
NEW POWER FEED

on famous DELTA 20" drill presses



NEVER BEFORE—"JOB TAILORED" DRILL POINT PRESSURE

A lathe-type cone clutch enables operator to adjust drill point pressure from 0 to maximum capacity of machine to permit power feeding on a production basis through a wide range of hole diameters. It furnishes power and thrust for drilling holes up to 1", yet delicately handles drills down to 1/16" diameter. Torque sensitive adjustability feature stops feed when overloaded—avoids drill breakage.



NEVER BEFORE—REMOTE CONTROL AND AUTOMATION

Actuating plunger, an extension of the clutch shaft, permits remote control which frees operator from manual effort. The power feed can be electrically, hydraulically, pneumatically, or mechanically interlocked with other machines or synchronized with devices such as rotary tables, clamps and work feeds for semi or full automatic operations.

Now Delta brings you advantages NEVER BEFORE AVAILABLE on a standard drill press—with the most advanced development in mechanical power feeds. Every model in the new Delta 20" drill press line offers power feed that gives you: *a front mounted pilot wheel for effortless one hand operation; infinitely adjustable drill point pressure; built-in feature that permits remote control or interlocking with automation devices.*

With the flexibility of feeds afforded by "flick of the wrist" control, operator's work is limited to loading, unloading, and actuating the tool. You get the adaptability of a power tool with the ruggedness, precision and capacity of a machine tool. Capable of handling production metalworking jobs done by machines costing much more, these new Delta power feed drill presses provide a simple, low cost method of increasing productivity and improving drilling quality.

Thoroughly tested through a rugged trial of 750,000 drilling cycles, Delta's new power feed line offers many other outstanding features and NEVER BEFORE AVAILABLE benefits that you cannot appreciate unless you see them demonstrated IN ACTION. Let your Delta Industrial Distributor show you how the 20" power feed drill press can help you cut costs (he's listed under "TOOLS" or "MACHINERY" in the Yellow Pages). Meanwhile, for FREE brochure giving details and specifications *plus* information on how to add New Power Feed to your present Delta 20" drill press, write: Rockwell Manufacturing Company, Delta Power Tool Division, 618F N. Lexington Avenue, Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Box 420, Guelph, Ontario.

DELTA INDUSTRIAL TOOLS

another fine product by

ROCKWELL

and they run
and they run
and they run

1903—
Indianapolis.
a trolley car.
a rolling adventure surrounded by noise.
pennies, nickels, children . . .

and inside—
a Fairbanks Morse electric motor.
it drove the trolley over thousands of miles
and rode with it
into glorious retirement.

pick a year—
from the turn of the century until now.
pick a month,
pick a day,
pick a city,
pick a town—
our motors are in its history . . .
pulsing, driving, working.
powering the things we need
and the things we want.
pushing our daily advances.
pulling us into the future.

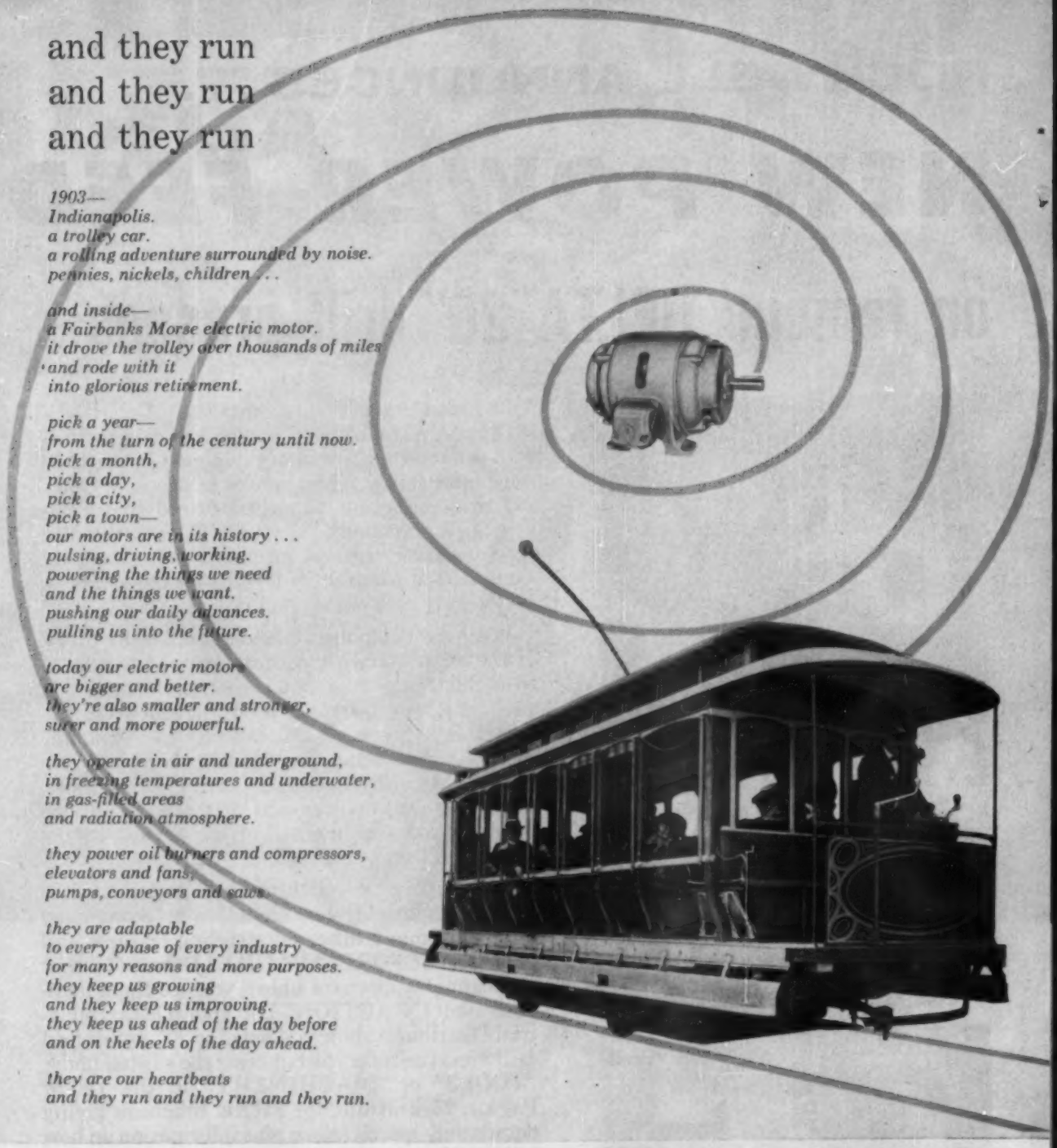
today our electric motors
are bigger and better.
they're also smaller and stronger,
surer and more powerful.

they operate in air and underground,
in freezing temperatures and underwater,
in gas-filled areas
and radiation atmosphere.

they power oil burners and compressors,
elevators and fans,
pumps, conveyors and saws.

they are adaptable
to every phase of every industry
for many reasons and more purposes.
they keep us growing
and they keep us improving.
they keep us ahead of the day before
and on the heels of the day ahead.

they are our heartbeats
and they run and they run and they run.



Fairbanks, Morse

A MAJOR INDUSTRIAL COMPONENT OF **FAIRBANKS WHITNEY CORPORATION**

The electric motor is one of the most versatile sources of power ever developed. It is economical, practical and time-resistant. Fairbanks-Morse electric motors can turn out ⅓ horsepower or 10,000 horsepower, meet every known job demand within this range or be custom-specified to your blue-print projections. Whatever your production needs or plans may be, our electric motors can power them.

If you are in a field where power for production must be efficient, effective and dependable—we suggest that you consider our great variety of electric motors. For further information please write to: Mr. George H. Herrick, Vice President and General Manager, Electrical Division, Fairbanks, Morse & Co., Freeport, Illinois.

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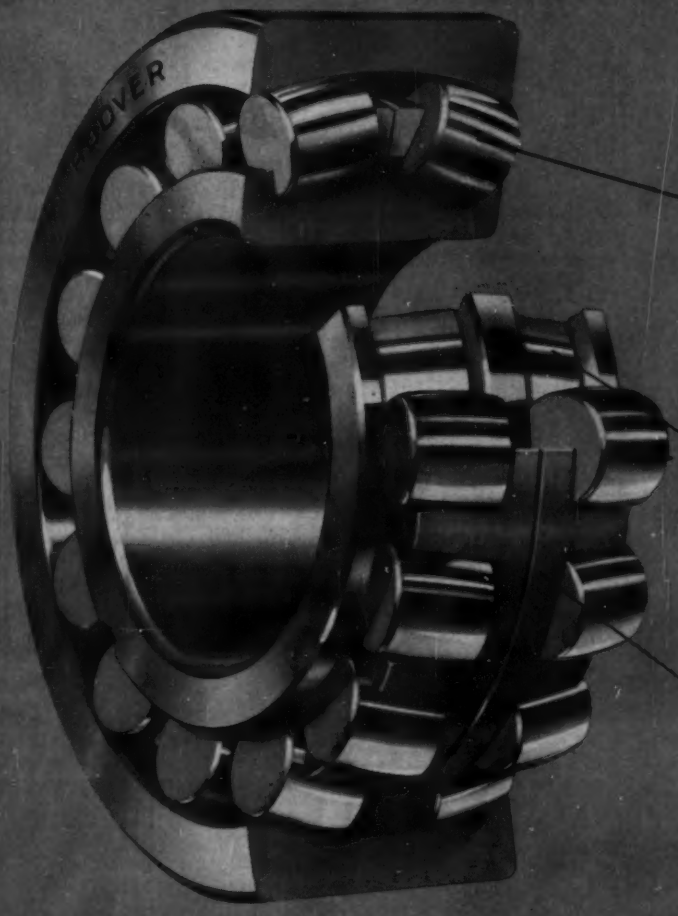
hoover quality

...WHAT IT MEANS IN SPHERICAL ROLLER BEARINGS



In spherical roller bearings, *Hoover Quality* means extra smoothness, extra precision, extra bearing performance.

Large size rollers are *Super Finished* to a mirror-like smoothness to minimize friction.

Both inner and outer raceways are *Super Finished* to match the smoothness of the rollers. Precision matching of rollers and raceways assures low operating temperatures and long life.

Land-riding retainers are accurately machined from solid bronze for proper roller guidance and uniform load distribution.

Hoover Quality spherical roller bearings are available in a complete range of sizes and series in cylindrical or tapered bore. Return the coupon below for complete information.

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5400 South State Road, Ann Arbor, Michigan AM-6

☐ Please send Bulletin 113 which describes Spherical Roller Bearings.

☐ Have your representative call.

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NEW TOOL STEEL SERVICE

simplifies purchasing (and saves money, too)

Buying assorted brands of tool steel creates costly paperwork for your . . .

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With Crucible's new Tool Steel Service you cut these costs substantially

because you buy fewer grades of tool steels to do more jobs . . .

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carry fewer pounds in stock (reduce chances of inventory "mix-ups"), and . . .

pay a lower price per pound (by eliminating costs for small quantity "extras").

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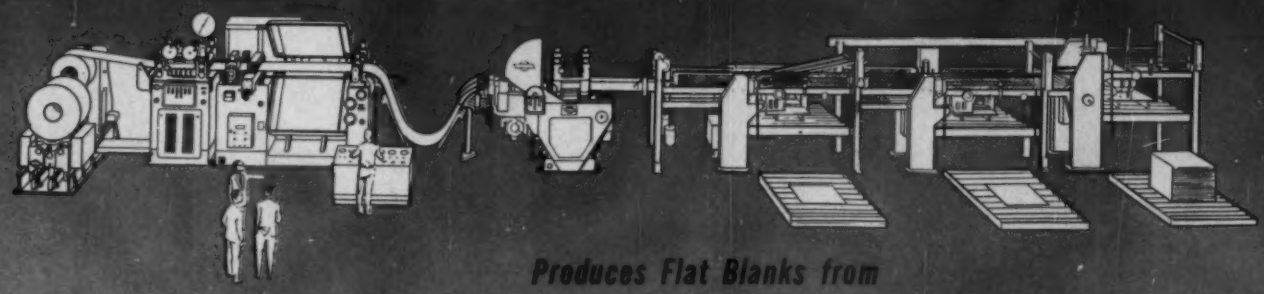
CRUCIBLE STEEL OF CANADA, LTD., SOREL, QUEBEC, CANADA

ONE SOURCE..

LITTELL

engineers, integrates and guarantees this

HIGH SPEED SHEETING LINE



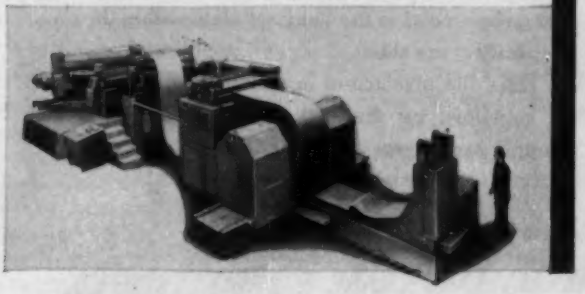
Produces Flat Blanks from Coil Stock .0055" to .020" ACCURATELY—within .007" in Length and Squareness FAST—75 three-foot blanks per minute!

TYPICAL LITTELL TINPLATE SHEETING LINES

At Crown Cork & Seal Company, these lines convert coil stock into flat sheeted tinplate, cut square, and to accurate lengths, in one continuous, automatic operation.

TYPICAL LITTELL TRAPEZOID SHEETING LINE

For The Budd Company, this Littell Trapezoid Sheeting Line converts heavier coil stock into custom cut rectangular, parallelogram and trapezoidal flat blanks for subsequent stamping and drawing operations.



The accuracy, the speed, and the low cost production record of this Littell line has made it standard equipment with the most exacting metalworking manufacturers. One company alone has 24 of these lines producing flat blanks. In every instance where the line has gone into service, the user has ordered more!

Littell engineers *and guarantees* the five complex individual units in the line to operate as one. Each unit is integrated and synchronized, one with the other, to produce flat blanks from mill coils faster, more accurately and at lower cost than has been possible before. Littell *guarantees* a tolerance of ±.007" in length and squareness in producing blanks up to 36" long at the rate of 75 blanks per minute. You get this accuracy on paper-thin .0055" tinplate or steel stock .020" thick. Operation is automatic, controlled by one man. Imperfect blanks are automatically rejected by electronic controls. Can manufacturers report the Littell line's scroll cutting efficiency saves six percent in material.

Whether you work thick or thin stock, a Littell Sheeting Line can work to your advantage and quickly pay for itself. Let's talk it over. 'Phone or write.

COILY SAYS:
"When you call or write, be sure you ask for Bulletin G-10."

F. J. LITTELL MACHINE CO.

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ROLL FEEDS • SHEETING LINES • STRAIGHTENING AND FEEDING MACHINES • REELS AND CRADLES FOR COIL STOCK

CIRCLE 196 READER SERVICE CARD

U. S. Steel Supply Provides Customers with **SMOOTH ACCURATE SHEARING**

One Shear Takes the Place of Two or Three

No. 12E-12 Steelweld Shear at U. S. Steel Supply, Seattle, Washington, rated for steel plate 12′ x ¾″. Being cut in photo is a plate, size 7′ x 30′ x ¾″. With hand crank on right end, this machine can be adjusted in a few seconds to have exactly the right knife clearance to obtain the finest cut for any thickness. To make this adjustment on guillotine-type shears usually requires several hours.

MANY steel warehouses have two and often three shears, one of a ¼″ capacity for lighter thicknesses, another of ½″ capacity for cutting ¼″ to ½″ material, and a third with 1″ capacity for thicknesses over ½″ and up to 1″. At some of its warehouses, U. S. Steel Supply uses only one machine for cutting the various thicknesses—a Steelweld Pivoted-Blade Shear.

One machine takes the place of two or three, because it is so easy to adjust the knife clearance required to obtain the best cuts for different thicknesses, which can range from lightest gauge metal to the heaviest plate within the capacity of the shear.

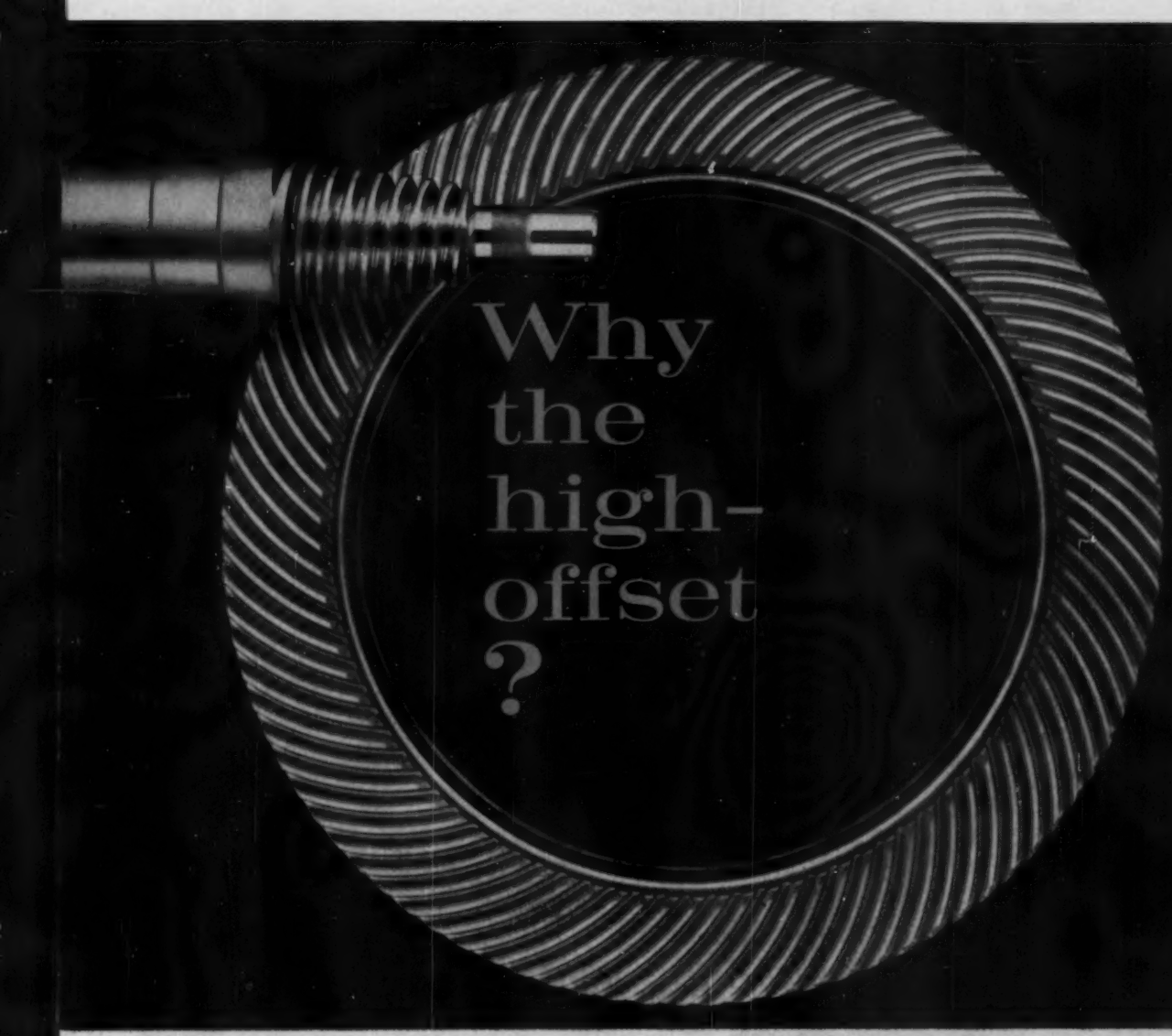
Thus, the investment in shearing equipment is kept low, yet the customers of U. S. Steel Supply are always assured of straight, smooth, accurately cut metal on every order.

GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.
1453 East 282 Street, Wickliffe, Ohio

STEELWELD PIVOTED BLADE SHEARS



...and where can you use it profitably?

High-offset makes a difference!

It's the difference that lets you combine *high-reduction* with strength, compactness and other advantages you might find profitable in certain applications. For instance . . .

For smooth operation—as in office equipment that must run quietly—high-offset pairs provide smooth, quiet tooth action. Because the teeth "wrap around" the pinion, *you get continuous action—even with just one or two teeth.*

Where space is a problem—as in instrumentation—the high-offset lets you design a more compact unit.

Choose just the offset to solve your design problem with a more flexible, more compact unit than the corresponding worm and wheel.

Where you need strength—as in farm machinery—high-offset hypoid pinions with teeth, which tend to "wrap around," are larger and stronger than corresponding bevel pinions.

High-offset or high-ratio hypoids can be cut on the same Gleason equipment that is used on more familiar spiral bevel and hypoid gears. You can also use the same testers, quenching presses and other auxiliary Gleason equipment you're using now. Grinders are available for applications requiring precision finish. For ratios of 1:10 or 1:40 or even higher.

Get more information by writing for free literature. Submit your prints for recommendations.

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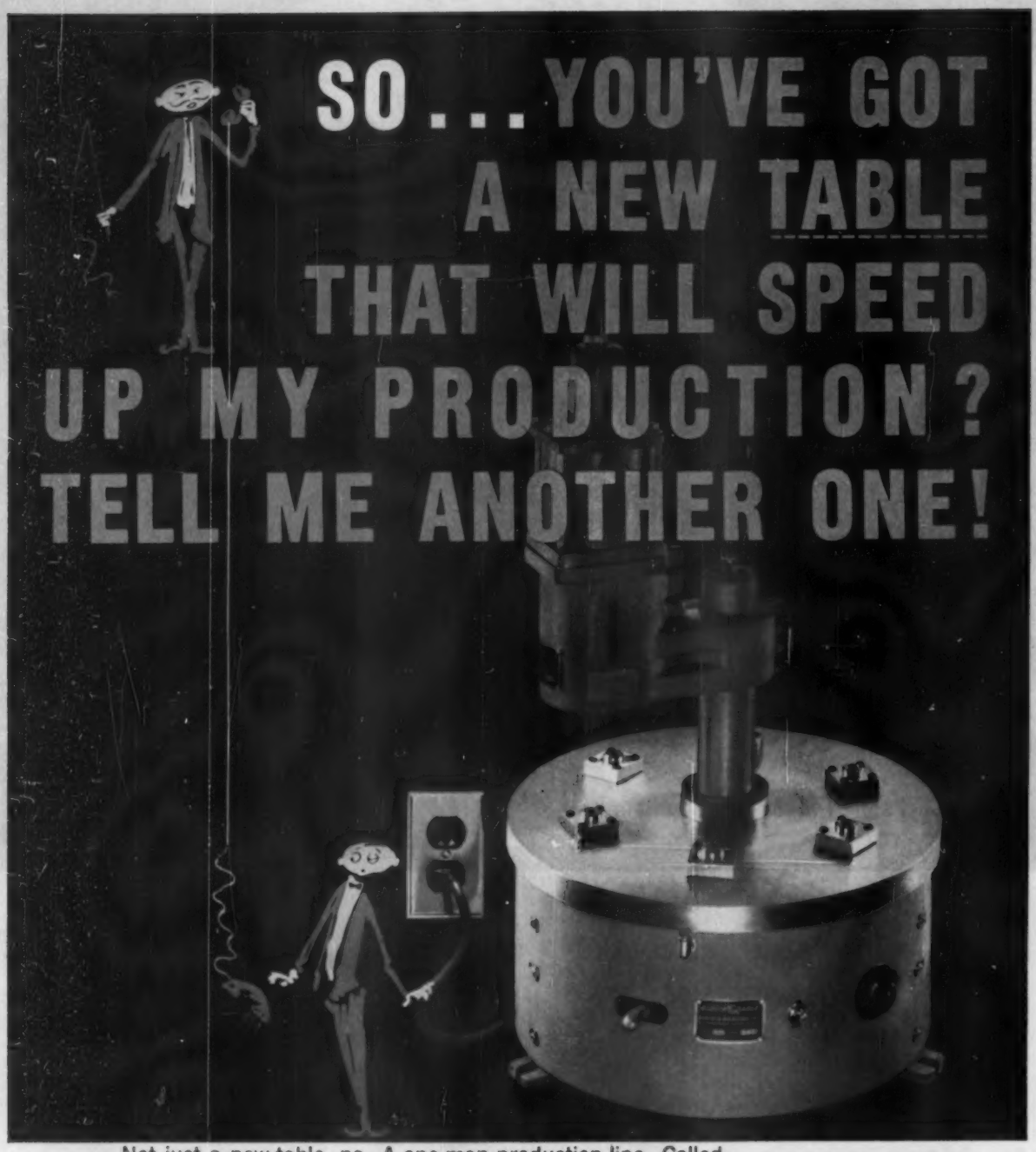
CIRCLE 198 READER SERVICE CARD



Not just a new table, no. A one-man production line. Called ***ELECTROTABLE***. All electric. Smooth, jolt-free Geneva action that can't be duplicated with air-operated tables. Built-in electronic timer. Easy on bench space. Positions work automatically, accurately, safely... and triggers other tools (preferably our own Electropunches) for various operations like staking, riveting or marking—to name just three. Six, eight, or twelve-station models. Adjustable speeds from 14-48 indices a minute. Indexing accuracy, .001". To change jobs, just lift turntable off, put new one on. Add automatic feeds . . . you've got automation! Like for example, hypodermic needle manufacturer — upped his hourly production from 1,500 to 4,000 using full automatic feed. Like component maker, who combined feeding, assembly, staking and went from 600 up to 2,000 units an hour. Worth investigating? Hope you'll think so.

BLACK & WEBSTER, INC. Dept. 3, 570 Pleasant St., Watertown 72, Mass.
PHONE: WALNUT 6-0100

ELECTROTABLE SPECIFICATIONS

Model LT — Counterclockwise Rotation

Model RT — Clockwise Rotation

Stations — 6, 8 and 12

Speed — continuously adjustable between 14 and 48 indices per minute.

(A timer that will provide 6 to 25 indices per minute is also available.)

Time for motion during one index .693 seconds

Indexing accuracy, ±.001

Diameter of table — 15¼"

Height of table above bench, 7¼"

Weight of unit less Electropunch head — 82½ lbs.

Electrical requirement: 115V or 230V AC, 50-60 cycle, 1 phase

To all metals Norton adds the first "Touch of Gold"

The term "precision-snagging" has yet to be invented – and the delicate touch is not a cleaning room technique. But snagging, the roughest, toughest, most basic type of grinding does benefit considerably by the "Touch of Gold" — built into all Norton grinding wheels to improve product quality and cut production costs.

Your operators, working on machines of any type or size, will like the easy, fast-cutting action of Norton snagging wheels. And *you'll* like the way they grind off more metal per dollar and turn out better work, bringing the true "Touch of Gold" to your production. See your Norton Man or your Norton distributor about test runs to determine exactly the wheels you need for best results on any metal. NORTON COMPANY, General Offices, Worcester 6, Mass.

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75 years of . . . Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

Only EX-CELL-O Contour Projectors* Give You ALL!

✓ CHECK THESE FEATURES!

☐ **LARGEST WORK AREA**—Constant eight inches of work space from lens to focal plane regardless of magnification. Plenty of room for large objects.

☐ **UNSURPASSED ACCURACY**—Famed Kodak Ektar® lenses guarantee reliable measurements with clear *accurate* images over entire screen.

☐ **BRILLIANT SURFACE ILLUMINATION**—Original design, "direct-on" built-in surface illuminator gives extra bright image and *full work clearance* at all magnifications.

☐ **ERECT—UNREVERSED IMAGE**—Correct, normal appearing images at all magnifications, eliminate confusion, simplify operation and save time.

☐ **COATED LENSES AND MIRRORS**—Produce clear sharp images characteristic of Ex-Cell-O Contour Projectors. Have been standard on all models for many years.

☐ **BRIGHT, GLARE-FREE SCREEN**—The "Fresnel" lens is exclusive with Ex-Cell-O, permits operator to see entire screen evenly illuminated from normal position. No "hot spots".

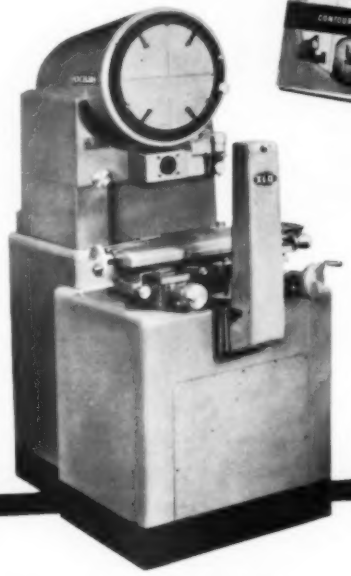
☐ **TRUE MEASURING PRECISION**—All Ex-Cell-O Contour Projectors not only read to tenths—they measure to tenths.

☐ **FINGERTIP CONTROLS**—Ex-Cell-O Contour Projectors are designed for maximum convenience and comfortable all day operation. Easy-to-reach controls.

☐ **RUGGED CONSTRUCTION**—The long established reputation of Ex-Cell-O for precision and quality assures years of trouble free operation.

☐ **YOUR OGP REPRESENTATIVE**—Will help you make sure you get the right Ex-Cell-O Contour Projector to fit your optical gaging requirements. Call him today!

Write for new edition of EX-CELL-O Contour Projector Booklet—Available Now!



*Manufactured by EX-CELL-O Corporation at Detroit, Mich.

SOLD AND SERVICED BY

OPTICAL GAGING PRODUCTS, INC.

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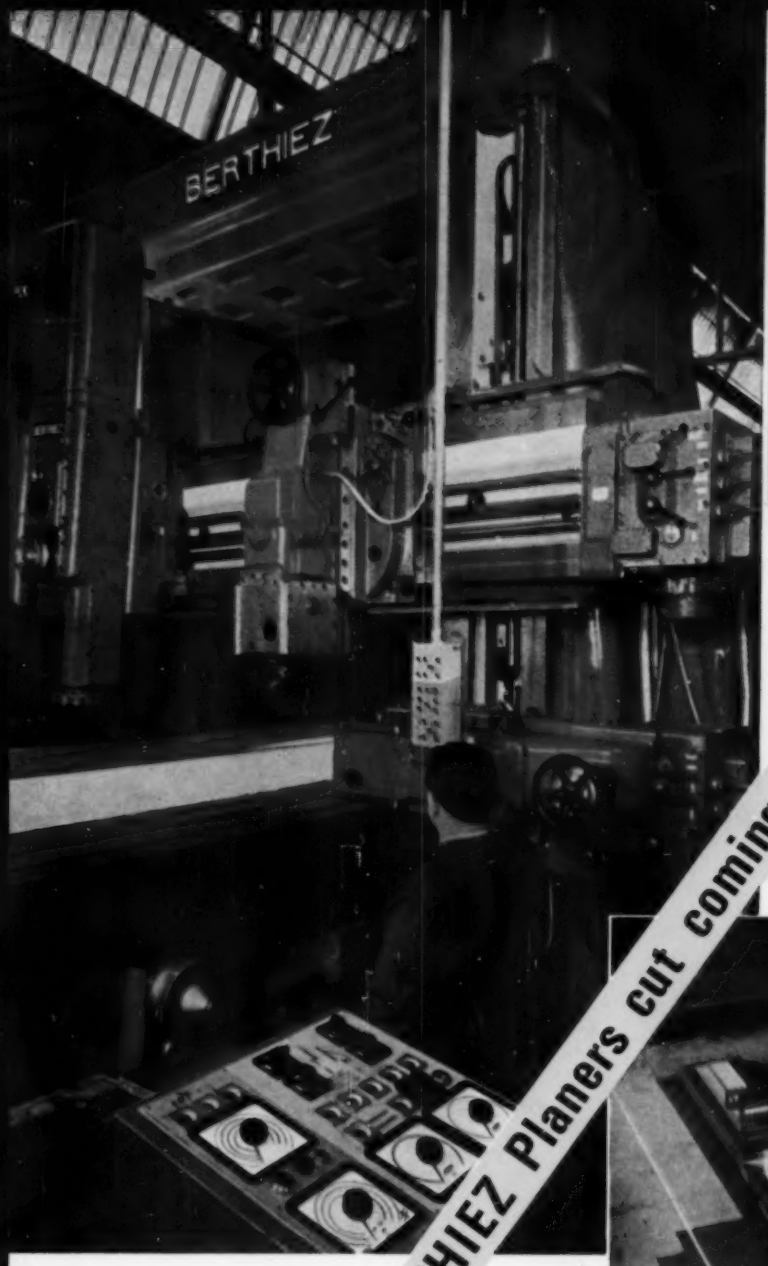
(A subsidiary of EX-CELL-O Corporation)

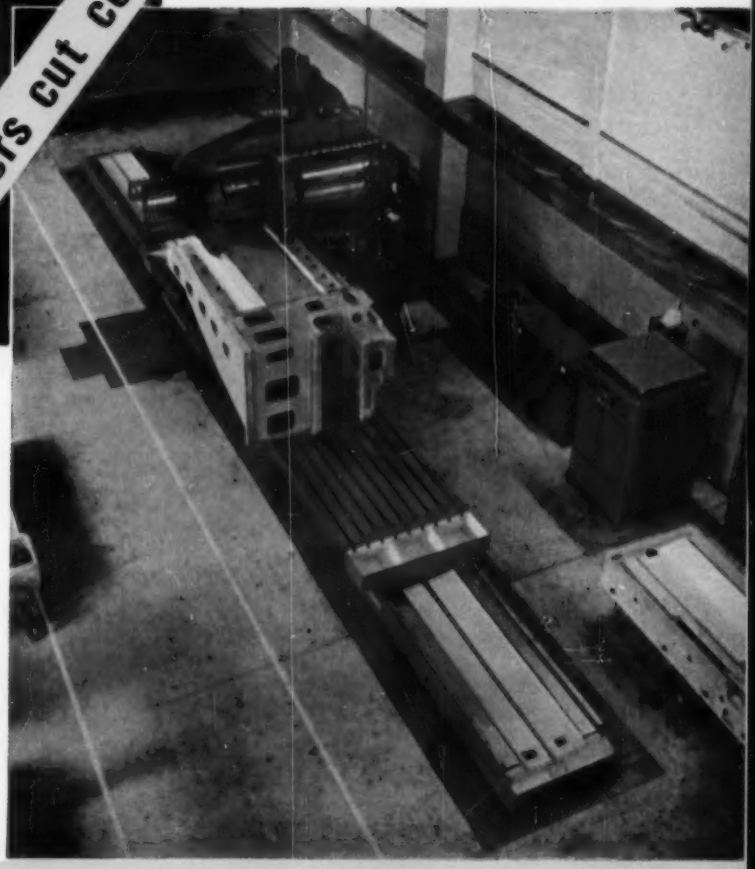
CIRCLE 201 READER SERVICE CARD

CIRCLE 202 READER SERVICE CARD ►



SINGLE and DOUBLE UPRIGHT PLANERS and PLANO-MILLING MACHINES

All BERTHIEZ Planers cut coming and going



BERTHIEZ

Société Anonyme des Anciens Etablissements Charles BERTHIEZ Givors (Rhône)

CIRCLE 202 READER SERVICE CARD

WORK-HOLDING BY WOODWORTH

THE WHITE MOTOR CO. SAVES TIME, IMPROVES QUALITY BY USING WOODWORTH'S BEVEL GEAR CHUCKS

PAUL POPERNEK, General Foreman of the Gear Dept., **THE WHITE MOTOR COMPANY,** Cleveland, analyzes the superior performance of Woodworth's Bevel Gear Chuck in his department; Mr. Popernek (left), discusses the chuck's adaptability with N. A. Woodworth Company's Sales Engineer, George Duke:

"Since we have been using the BC 1700 Woodworth Chuck, arranged to locate from the pitch line for hard grinding the bore and backface of our Rear Axle Bevel Drive Gears, we have eliminated one operation and have reduced the grinding time by approximately three minutes per gear. In addition to reducing the grinding time, we are producing higher quality gears with relation to the pitch line and the bore, thereby reducing lapping time for the gear and pinion.

"This chuck has been adapted to handle a range of gears from 16¼" P.D. to 18½" P.D. and is tooled up to grind 10 ratios of the 18½" gears and 8 ratios of the 16¼" gears—a total of 18 ratios on one chuck!"

In the above illustration **WOODWORTH'S 17" BEVEL GEAR CHUCK** is installed on a Bryant 1120 J Internal Grinder. Three clamping fingers firmly hold the gear against five carbide ball locating pins. Quick change-over from one gear size to another is accomplished easily by interchanging units comprised of a locater plate complete with carbide pins and a set of clamping fingers. Set-up time is thus reduced to a minimum.

WRITE FOR CHUCK CATALOG 3-58

When You Buy, Specify

ACCURACY W TOOL CAN TRUST

WOODWORTH

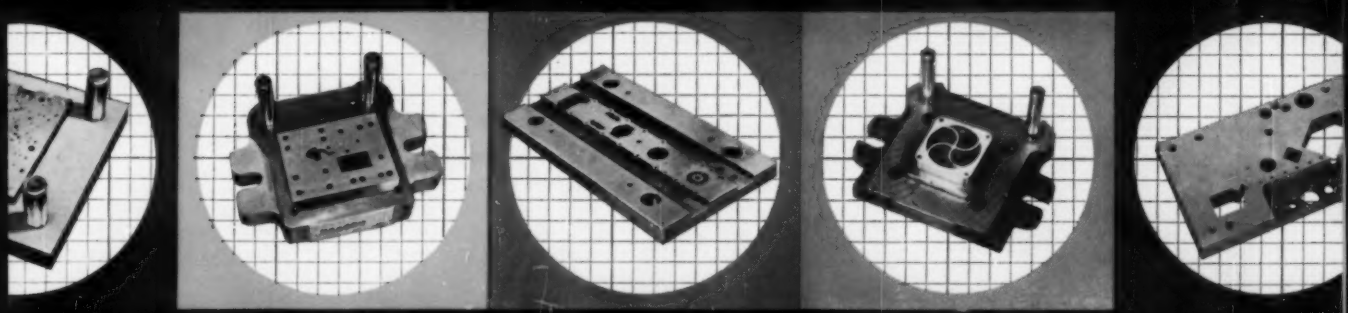
1300 EAST NINE MILE ROAD • DETROIT 20, MICHIGAN

eg

air-hardening tool and die steel (A.I.S.I. Type A-6), produced by Carpenter's exclusive MEL-TROL® process, offers unmatched uniformity and cleanness from surface to core, end to end, lot to lot. VEGA-FM combines the toughness, machining properties and simple low temperature heat treatment of an oil-hardening steel with the safety in hardening of an air-hardening grade. Prove for yourself its superiority.

Call your local Carpenter SERVICE-CENTER now for immediate delivery.

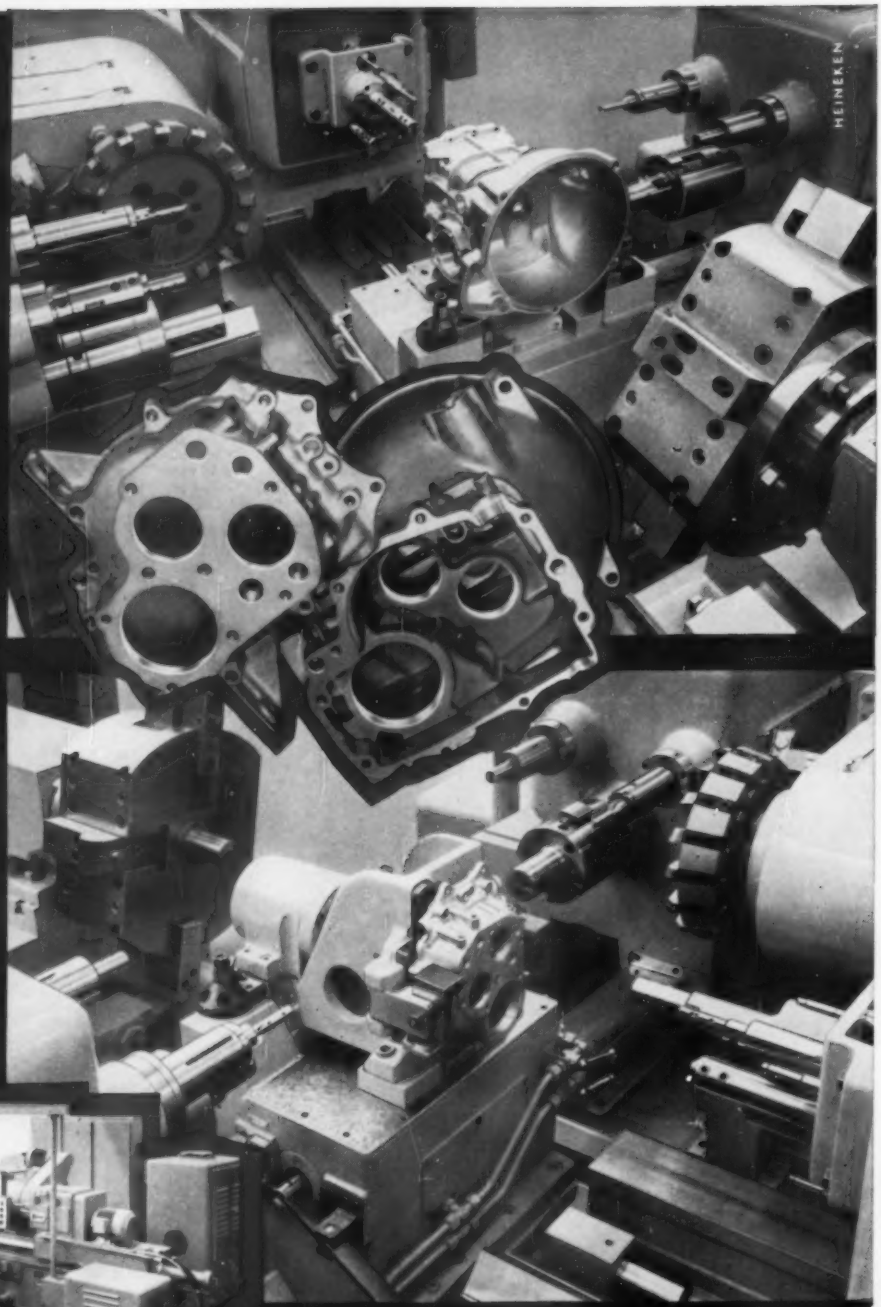
the *Carpenter* Steel Company, Reading, Pa.

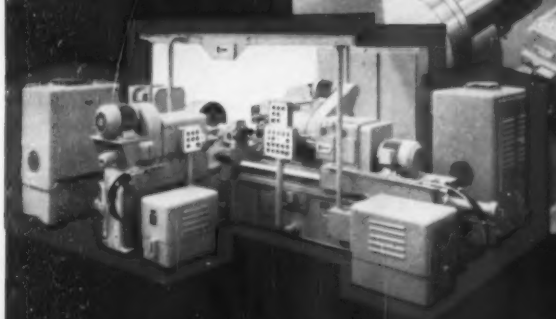


Burr

LUDWIGSBURGER MASCHINENBAU GMBH

LUDWIGSBURG/WUERTTEMBERG, GERMANY





SUPERFINE BORING MACHINES FOR MAXIMUM PRECISION

Five-way machine with 17 spindles for borir g and superfine boring, facing, chamfering and milling gear boxes and gear box covers.

Performance: 14 gear boxes and 22 gear box covers per hour

Precision Ground

Atrax SOLID CARBIDE TOOLS AND BURS

Job Applications

New cutting efficiency has been designed and engineered into a new line of Atrax Stub Routers. These are solid carbide standard, off - the - shelf tools available in nine sizes from 1/16" to ½" diameter and 1" to 1½" in length.

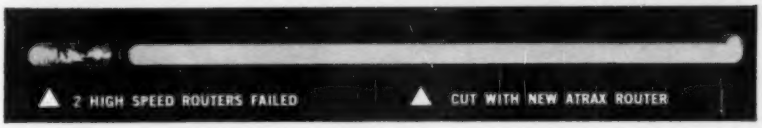
Precision ground, the Series 1546 Router has a single, straight flute, straight shank and right hand cut. Tolerances are kept to +.000 −.003.

NEW ATRAX STUB ROUTER PLUNGES, SLOTS, FORMS EXTREMELY HARD-TO-CUT MATERIALS

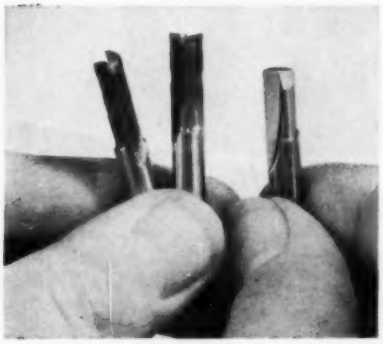
SHOP TESTS PROVE SUPERIORITY

This photo shows the second of two high speed steel routers failing to cut copper clad Fiberglas printed circuit board. Note the burning of tool and material and the jagged hole at left in test work piece.

The new Atrax Router plunged and cut at 20,000 rpm leaving clean slot shown at right.



COMPARISON OF TEST TOOLS

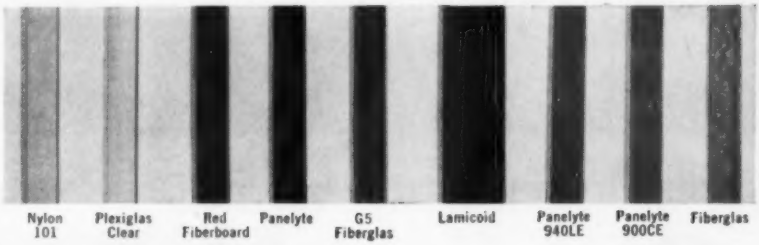


Two high speed routers on left were unserviceable after a few seconds. Atrax Solid Carbide Router showed no wear land and left clean slot with no bur on either side of printed circuit board.

ADDITIONAL TESTS ON OTHER TOUGH MATERIALS

Nine other materials commonly used in printed circuit board work were tested. All were cut quickly and efficiently with the new Atrax Router.

These materials can also be drilled readily with the new Atrax Micro-Drills available in wire sizes from #1 to#80.



SOLID CARBIDE TOOLING RESULTS

in savings in production time and in experimental prototype circuit board work. Many of the new extremely tough materials can be worked faster, easier with Atrax Routers, Drills and End Mills. The Atrax Company will be pleased to furnish information on speeds and feeds recommended for best results.

Send for 148 Page "Standard Reference" on Solid Carbide Tools.

THE ATRAX COMPANY
240 DAY STREET
NEWINGTON, 11, CONN.

CIRCLE 206 READER SERVICE CARD

CIRCLE 207 READER SERVICE CARD ►

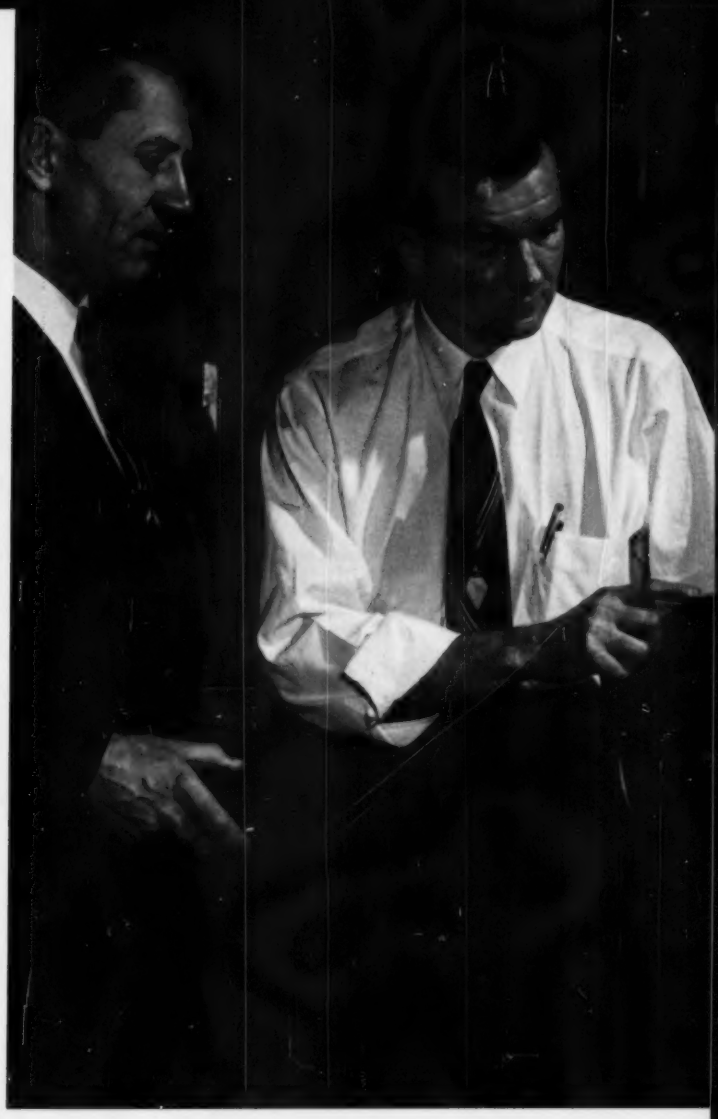
Iron Fireman Manufacturing Company changes to Gulfcut® oil,

GULF MAKES THINGS

A machining job that had been a problem for years was the test given a Gulfcut oil at Iron Fireman Manufacturing Company, Cleveland, Ohio. The job was hobbing 78-tooth, combination 6-8 pitch main drive gears of UMA-3 forging steel. Until the test, hobs had to be reground after every eight gears—once every cutting cycle.

By using Gulfcut 21C oil, Iron Fireman engineers found that they could get the same tolerances and the same production as before, and that they could cut approximately 30 gears or nearly 4 cycles before re-grinding. In addition, they were grinding one-third less off the hobs than before!

"With 275% increase in hob life, we're getting pretty close to optimum on this job," says Stanley J. Kovac,



At right, C. J. Wires, of the Production Engineering Staff, Iron Fireman Manufacturing Company, with T. F. Irving, Gulf Sales Engineer who recommended Gulfcut.

More than 300 kinds of steel, cast iron and brass gears are hobbed by Iron Fireman Manufacturing Company, all with the aid of Gulfcut oils. Pictured here is a 12-tooth, 6 pitch Ledloy steel pump drive gear, O.D. 2.333, tolerances +.0000, −.0015. Oil is Gulfcut 21C.

increases hob life 275% . . .

RUN BETTER!

Chief Production Engineer. "Performance like this has proved Gulfcut oil to us. We're now using it on all gear cutting operations. We cut 300 kinds of gears, of brass and cast iron, as well as steel."

Do you have a tough machining problem? See how Gulf makes things run better! Just call a Gulf engineer at your nearest Gulf office.

GULF OIL CORPORATION
Dept. DM, Gulf Building
Pittsburgh 30, Pa.

GULF

SP-9822

Fine tools that encourage Good Work

ARMSTRONG WRENCHES

An ARMSTRONG Wrench feels right—is balanced. It goes over nuts or screw heads easily, grips firmly without sloppiness, won't round corners—because openings are carefully machined to correct sizes. It's safe, strong beyond need without clumsy bulk—because of superior design and selected steels, heat treated to proper degree of hardness and tensile strength. It's quality finished, ARMALOY (alloy steel) Wrenches in chrome plate with heads buffed; HI-TEN (carbon steel) Wrenches in baked-on gray enamel with heads ground bright . . . all plainly marked for size. All are uniformly excellent tools manufactured under strict quality control, by modern methods, with modern equipment in a modern tool plant . . . 1537 different industrial sizes and types—single wrenches, or sets in metal cases, boxes or rolls . . . each a quality tool. Armstrong Wrenches are "Fine tools that encourage good work."

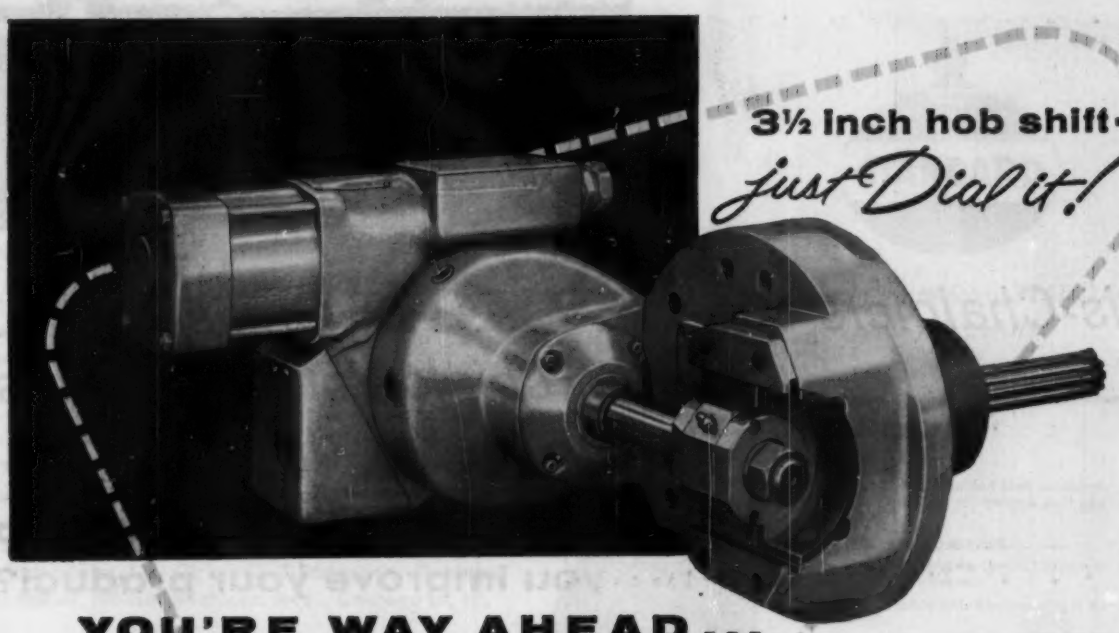
INDUSTRIAL DISTRIBUTORS · SERVING INDUSTRY ECONOMICALLY · THE RIGHT HAND OF PRODUCTION

If you don't know your local ARMSTRONG Distributor, we will send you the names of those in your area.

ARMSTRONG BROS. TOOL CO. 5215 W. ARMSTRONG AVE. • CHICAGO 46, U.S.A.

◄ CIRCLE 208 READER SERVICE CARD

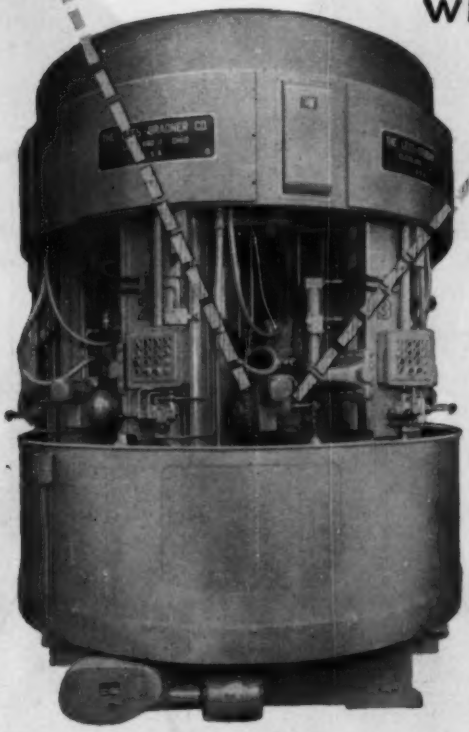
CIRCLE 209 READER SERVICE CARD



3½ inch hob shift—
just Dial it!

YOU'RE WAY AHEAD...

with THIS HOB HEAD



LEES-BRADNER
7-HD 6-spindle hobbing machine
(Heavi-Duty)

...another FIRST from LEES-BRADNER!

Your business is to make money.

Our business is to help increase your production and lower your costs so you can make money!

The super-efficient hob head of the Lees-Bradner 7-HD line of modern hobbing machines makes them the most versatile, fast and accurate machines for gear cutting industry has ever known.

Put teeth in your future money-making, time-saving production plans! Step up to Lees-Bradner and cut down your gear hobbing costs.

Right now send for your 7-HD brochure and get the complete money-saving facts about the 7-HD hobbing machines—in single, 4 and 6-spindle models.

IMPROVING GEARS... FOR 50 YEARS!

the LEES-BRADNER Company
CLEVELAND 11, OHIO, U.S.A.

CIRCLE 210 READER SERVICE CARD

CIRCLE 211 READER SERVICE CARD ►

Allis-Chalmers uses **RYKON** *Grease in bearing shield—offers farmers better disc harrow*

can **RYKON** Grease help you improve your product?

Above: Maynard Walberg sweeps sand back over disc harrow bearings on test stand. RYKON Grease is undergoing 2,000-hour test in this simulation of actual farm service conditions.

Below: Allis-Chalmers disc harrow ready for shipment from the plant gets inspection from Standard's Fred Parkinson and Walberg.

Maynard Walberg, Allis-Chalmers project engineer, and Standard Oil lubrication specialist Fred Parkinson, examine disc harrow bearing assembly. Fred is well equipped through training and experience to help industrial customers with lubrication problems. He has been doing this work for 11 years at Standard. He has a degree in chemistry and engineering from Brown University. Plus that, he has completed the Standard Oil Sales Engineering School.

Situation: Bearings of a disc harrow in service are always turning in dusty conditions, oftentimes completely covered with soil. Such bearings in the Allis-Chalmers harrow are protected with grease-coated rubber shields. The grease guards against dirt getting past the shield and into the bearing.

What was done: Allis-Chalmers project engineer in the LaCrosse, Wisconsin plant, Maynard Walberg, called Fred Parkinson, Standard Oil lubrication specialist, for a sample of RYKON Grease. In conditions simulating field service, RYKON Grease was tested. Bearings were rotated in the most abrasive dirt available—Mississippi sand with a high quartz fraction.

What happened: Tests were started and run to destruction. Prior to the use of RYKON Grease, bearing failures occurred at 500 hours. On switching to RYKON Grease, these tests were pushed to 2,000 hours. At this point, tests were stopped. Bearings were still in operating condition.

What you can do: Find out how RYKON Grease might help you offer your customers a better product. Inquire of the Standard Oil lubrication specialist nearest you anywhere in the 15 Midwest or Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 So. Michigan Ave., Chicago 80, Ill.**

STANDARD

You expect more from STANDARD and you get it!

Quick facts about RYKON

- Heat stable. At sustained high temperatures RYKON Grease remains soft and grease-like.
- Resistant to water-washing.
- Mechanically stable. Minimum change in consistency in service.
- Resistant to oxidation. Thickener acts as an inhibitor.
- Exceptional rust-preventive properties.

All Pressure Regulators are not alike

Norgren

Balanced valve construction

The Norgren extra, assuring more uniform air pressure regulation

You buy an air pressure regulator for just one purpose: because you need accurately controlled pressure.

However, with any compressed air system, there are two operating conditions that, separately or together, can produce a change in the regulated pressure: 1. Fluctuations in line or supply pressure, and 2. Variations in air flow demand by your air-operated equipment.

That is why Norgren developed the balanced valve.
The balanced valve gives the Norgren Regulator an extra efficiency in compensating for changes in line pressure and changes in flow demand. As a result, the Norgren Pressure Regulator maintains the uniform delivery pressure you need, under any and all operating conditions.

Whatever your pressure regulation need, there is a Norgren Pressure Regulator designed for the job. Call your nearby Norgren Representative listed in you telephone directory—or WRITE FACTORY FOR DESCRIPTIVE LITERATURE.

FOUNDED IN 1926

C. A. NORGREN CO.

3436 South Elati Street · Engelwood, Colorado

Norgren Pressure Regulators give you these important features:

Balanced Valve Construction—Improved regulator performance

Large Nylon-reinforced Buna N Synthetic Rubber Diaphragm—long service life

Baffle and Siphon Tube—increased accuracy

Large Passages and Valve Openings—large flow capacity

Easy servicing while still on air line

Flexible Valve Pin—assures better seating

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CIRCLE 213 READER SERVICE CARD

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most extensive sawing experience

LADISH *Controlled Quality* SAW BLADES

ARE ESTABLISHING NEW STANDARDS
OF CUTTING PERFORMANCE AND DEPENDABILITY

- Sustained cutting efficiency.
- Long, dependable blade life.
- More cuts per dollar.
- Plus a consultation service based on vast experience in cutting over a million tons of metal in a wide range of specifications.

...These are direct advantages to users of Ladish blades—the complete quality line marketed by one of the largest users of saw blades.

PROVE TO YOURSELF THE ADDED LIFE AND CUTTING EFFICIENCY OF LADISH BLADES

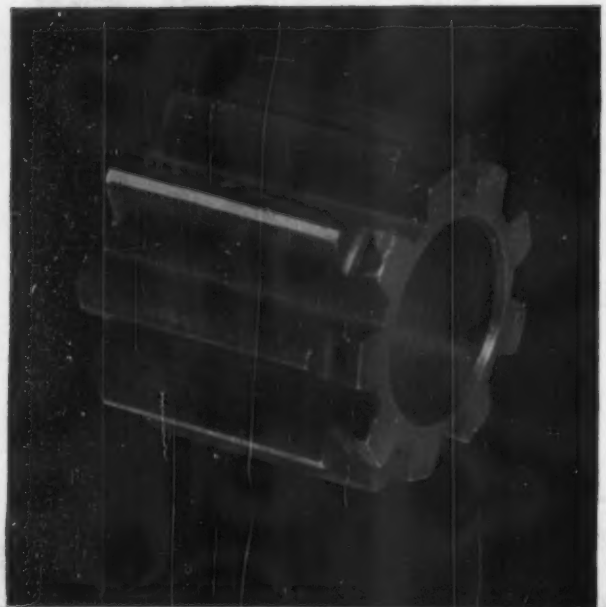
HANDY POCKET SIZE CUTTING GUIDE AND CATALOG
Contains answers to cutting problems. Provides quick reference to saw blade specifications.
Write for Bulletin 578.

COMPLETE LINE OF TYPES AND SIZES
AMPLE STOCKS • EFFECTIVE PACKAGING
CONSULTATION SERVICE ON CUTTING PROBLEMS

LADISH CO.

CUDAHY (Milwaukee Suburb) WISCONSIN • Sales Offices and Plants in Principal Industrial Centers
LADISH PRODUCTS INCLUDE: SAW BLADES...PIPE FITTINGS...VALVES...DROP FORGINGS...ROLLED RINGS

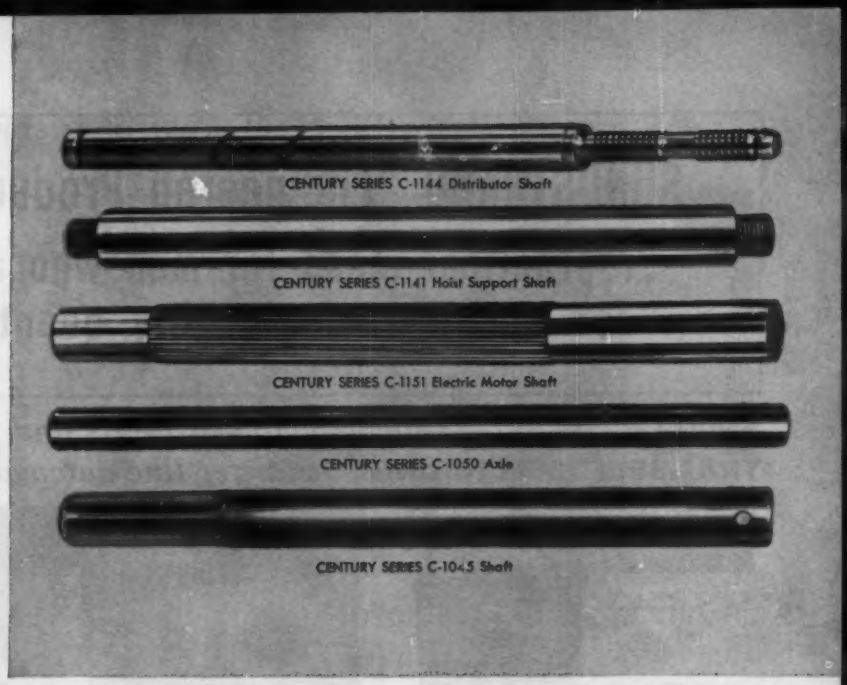
MACHINING HIGH-STRENGTH METALS



TITANIUM WAS CUT, GROUND, TAPPED, spot welded, heat treated, and hand forged by the Crane Co., Chicago, Illinois. Parts produced were valve components—lower stems, disc stem rings, and disc and stem ring pins—used in Freeport Nickel Company's new $119,000,000 nickel-cobalt processing facilities. Crane reports that Republic Titanium permitted close-tolerance machining with considerably fewer rejects than anticipated.

ALLOY STARTER DRIVE PINIONS ARE MACHINED by Eclipse Machine Division, Bendix Aviation Corporation, Elmira, New York. Subject to extreme torque, impact, and wear, these pinions are produced from Republic Type 8716 Cold Drawn Alloy Steel. Bars are blanked, hobbed, chamfered, and drilled. Teeth are cut on a gear hobber and pointed for easy meshing with the flywheel. Send for details on Republic Cold Drawn Alloy Steel.

CIRCLE 315 READER SERVICE CARD


CENTURY SERIES C-1144 Distributor Shaft
CENTURY SERIES C-1141 Hoist Support Shaft
CENTURY SERIES C-1151 Electric Motor Shaft
CENTURY SERIES C-1050 Axle
CENTURY SERIES C-1045 Shaft

FIVE DEGREES OF MACHINABILITY are offered by Republic's CENTURY SERIES of cold finished, stress-relieved, carbon steel bars. Of five grades—C-1045, C-1141, C-1144, C-1150, and C-1151—each provides a minimum yield strength of 100,000 psi. Proper selection can result in a more economical combination of strength and machinability. The CENTURY SERIES is characterized by dimensional stability with high physical properties over a range of chemistries. Return coupon for data.

STAINLESS STEEL IS MACHINED into one-piece Hyseal Valve Stems for new American-Standard single-lever mixing faucets by the National Acme Company, Cleveland, Ohio. Completed in a single setup, 10 operations including a multiple end drilling of six holes on a 15° angle are performed on the Republic Type 303 Stainless in 12 seconds. For information on the more than 40 types of stainless steel available from Republic, mail the coupon.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
DEPT. AM-9567
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send more information on:

- ☐ Cold Drawn Alloy Steel
- ☐ Republic Titanium
- ☐ Metallurgical and Machining Service
- ☐ CENTURY SERIES
- ☐ Stainless Steel

Name_____ Title_____

Company_____

Address_____

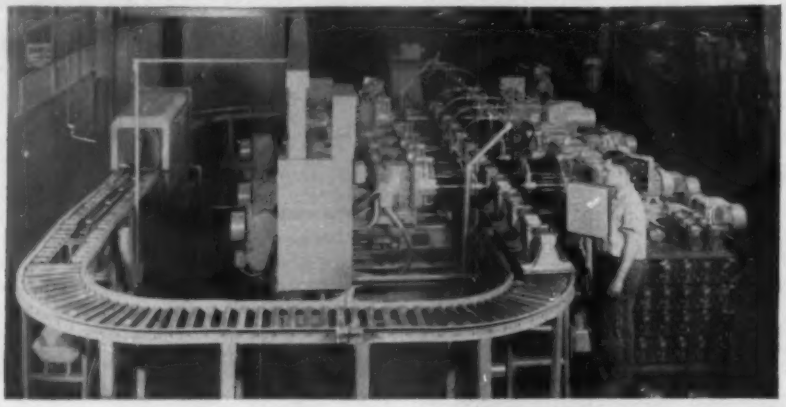
City_____ Zone____ State_____

CIRCLE 216 READER SERVICE CARD

SUNDSTRAND "Engineered Production" METHODS

...practical ideas for men who are responsible for manufacturing quality, quantity, and profit

SMALL-LOT TRANSFER MACHINING *Quickly changed heads and fixtures bring cost cutting transfer line automation to small-lot jobs.*



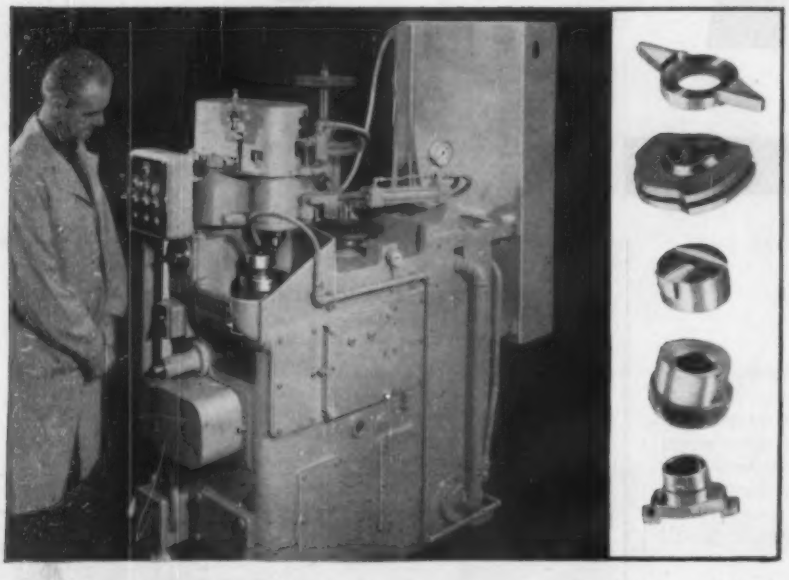
The economies of transfer line processing no longer are limited to large-volume production. This new six-station Sundstrand pallet-type transfer line is being used to process a "family" of five different hydraulic unit housings in lots as small as 500 to 1000 pieces.

The machine drills, spot faces, bores and taps the parts to precision tolerances. Milling and boring heads can be added to or replaced in the line as required. Two men can change a complete machine setup of 12 pallet-supported fixtures and 12 heads in less than five hours.

Constructed basically from standard units with specially designed pallets, fixtures and tooling, this transfer line is a typical result of a Sundstrand "Engineered Production" analysis of a specific machining requirement.

Details on request.

CONTOUR MILLING *Intricate external and internal contours easily milled on small parts with Sundstrand cam-controlled machine.*



This Sundstrand contour milling machine is adaptable to a countless number of cam milling operations on small parts for sewing machines, guns, business machines, governors, and many other products.

The vertical cutter spindle and cam follower spindle are mounted together on a pivoting arm with a 2 to 1 ratio, which reduces any cam error to ½ on the finished part.

One operator is able to attend several of these machines and produce accurate parts faster and more economically than with conventional methods.

A wide variety of machine cycles permits internal and external contour milling of workpieces up to approximately 5" diameter. For complete information, ask for Bulletin CM-617, and describe your requirements.

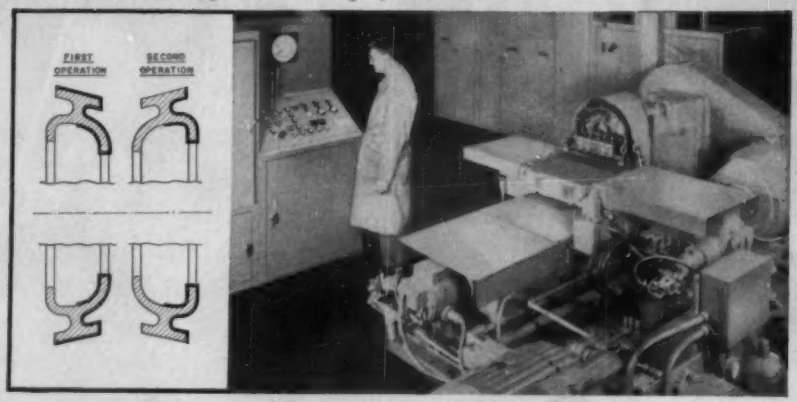
NUMERICALLY CONTROLLED TURNING

Sundstrand lathe turns turbine rings faster, more accurately than by former method.

This new Sundstrand numerically controlled lathe contour-turns stainless steel turbine rings to precision tolerances and finishes in two completely automatic cycles.

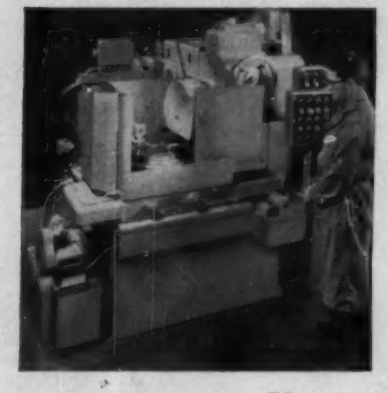
Speeds, feeds, order of presentation of each of the five carbide tools, and the path of each tool are controlled numerically. Production is increased and finish and tolerance more easily maintained than by the former method of machining.

If you want to explore the opportunities for profitable turning in your shop, ask for an "Engineered Production" analysis of your jobs.



ROTARY SURFACE GRINDING

High-production rough and finish grinding of clutch plates to a flatness of .001″ with .005″ repeatability.



Long ways, a rugged column, and precision construction allow this 20-hp Sundstrand-Arter machine to rough and finish grind 14″ clutch plates to an over-all flatness of .001″, total indicator reading — repeatability within .005″ at a rate of 45 sides per hour.

Required finish of 30 to 40 microinches is readily held; but finer finish is obtainable with this machine. Stock removal is from .009″ to .012″.

The entire cycle is automatic, except for loading and unloading. The operator places a clutch plate on the concentric pole magnetic chuck of the first machine and the grinder fast feeds for heavy stock removal, then automatically changes to slow speed for fine finish. The clutch plate is then reversed and the operation repeated on second machine. Total production thus is 45 pieces per hour (at 85% efficiency).

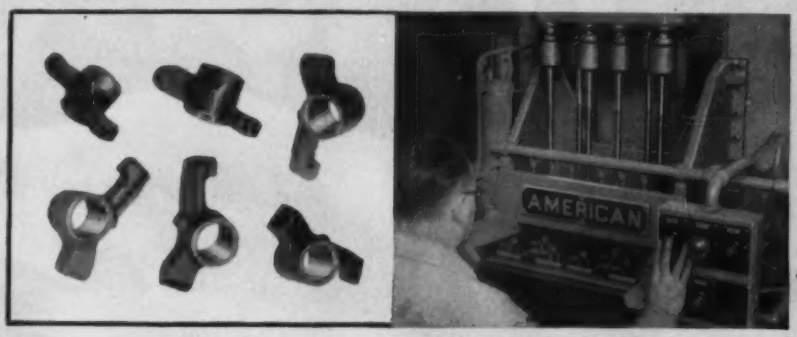
Compensation for wheel wear or wheel dressing doesn't disturb the feed setup on this versatile grinder. Also, it has a tiltable table for concave or convex grinding. Available in toolroom or production types. For details, ask for Bulletin G-617.

BROACHING

Vertical internal pull-up machine with sliding fixture handles 1200 parts per hour, six at a time.

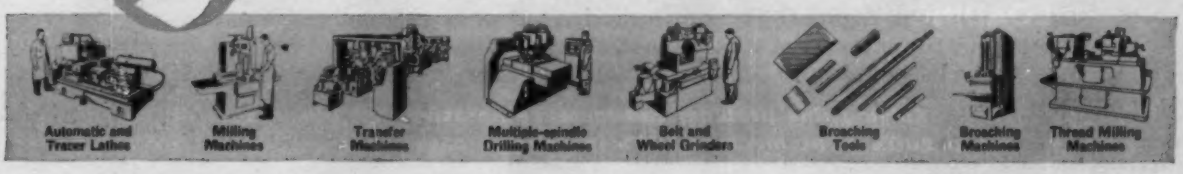
An ideal combination of machine, proper tool design, and an efficient fixture provides highly productive broaching of the ID of hole in the exhaust valve rocker arms illustrated — 1200 finished parts per hour.

The hydraulically operated workholding fixture, designed and built by Sundstrand, features easy loading, positive clamping during broaching cycle, and automatic parts ejection. The operator loads a fixture slide while six parts are passing through the broaching cycle.



SUNDSTRAND MACHINE TOOL

BELVIDERE, ILLINOIS • DIVISION OF SUNDSTRAND CORPORATION



LOADING

A problem condition causing loss of belt life and efficiency. Loading can be detected by the appearance of metal particles packed in between the abrasive grains of the belt coating. In some cases, the abrasive grain is completely covered.

Solving this problem can increase abrasive belt life in your plant up to 200%... as much as 500% in extreme cases.

GLAZING

This common problem condition accounts for 60 per cent of all belt-grinding troubles. The face of a glazed belt is smooth and glossy. This appearance is caused by an actual dulling of the abrasive grain tips.

Eliminate glazing and increase belt life up to 150%.

STRIPPING

A condition in which particles of the grain and bond are actually pulled away exposing the bare backing of the belt.

Eliminate stripping and get increased belt life from 20% to 200%.

Coated Abrasives Division, The

do you have these abrasive belt problems in your plant?

LOADING PROBLEMS SOLVED AT ZIPPO MANUFACTURING CO.

A 300 per cent increase in belt life was realized on a polishing operation at Zippo, one of America's leading manufacturers of quality cigarette lighters, *through the elimination of belt loading.*

These three abrasive belt problems are the major causes of reduced belt life, decreased production-per-belt and higher operating and abrasive costs. Eliminate them and you can boost belt life by as much as 500 per cent!

Loading, glazing or stripping can result from the wrong choice or application of abrasive belts, contact wheels, lubricants as well as improper belt pressures and machine speeds.

Extensive research in CARBORUNDUM'S Coated Abrasives Laboratories at Niagara Falls, New York has produced a wealth of valuable information on the causes and solutions of abrasive belt problems. CARBORUNDUM'S factory and distributor representatives have now been equipped with this *new* and *exclusive* information to help you improve abrasive belt life in your plant today. Ask your local CARBORUNDUM distributor or write to:

CARBORUNDUM®

CARBORUNDUM COMPANY, *P. O. Box 477, Niagara Falls, N. Y.*

CIRCLE 220 READER SERVICE CARD

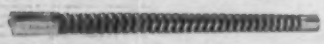
INSTANT KEYWAYS

for a penny apiece

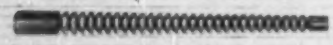
With Minute Man Keyway Broach Kits you can cut keyways in one minute for as little as one cent. For keyways from 1/16" to 1" in any bore from 1/4" to 3".

SAVE TIME WITH THESE OTHER STANDARD STOCK BROACHES

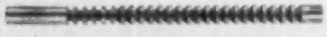
Minute Man®



SQUARE BROACHES
For finishing 1/8" to 3/4" square holes in one pass in cast or drilled bore.



HEXAGON BROACHES
For finishing 1/8" to 3/4" hexagonal holes in one pass in cast or drilled bore.



ROUND BROACHES
For finishing 1/4" to 1" round holes in one pass in drilled bore.

SEND FOR CATALOG AND PRICE LIST

The duMont Corp., Greenfield, Mass.

MAIL FREE BROACH CATALOG AND PRICE LIST A describing Square Broaches, Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

Name .....

Company .....

Address .....

duMont

LETTERS

to the editors

330 W 42nd St, New York 36, NY

Blind-Hole Tapping

Dear Sirs:

On the article, "Blind-Hole Tapping Can Be Painless" (*AM/MM*—Mar 7 '60, p96), I would like to call your attention to the following errors:

In the third paragraph, the first bullet says, "Select the coarsest practicable pitch relative to hole diameter." It should read, " . . . finest practicable pitch . . ." instead of coarsest.

Figure 1 should be re-drawn to show a gradual and almost linear increase in tapping torque with increase in tap size. The diagram as it was published shows no increase in tapping torque with tap size.

This is in error, of course, and the red line showing tapping torque should be angled upward to the right. This effect should be such that the tapping torque for 5/16-18 should be almost twice that shown for 1/4-20 NC. The red line for breaking torque should also be angled upwards by the same amount. The object of this figure is to show the considerably higher safety factor between tapping torque and breaking torque as tap size increases.

Section 3, dealing with stringy chips, refers to Fig. 7 when it should have referenced Fig. 6. Similarly, section 8 on cutting fluids makes the mistake of referring to Fig. 9 instead of Fig. 8.

I think the following additional thoughts might clarify some other points in the article:

In Fig. 7, the increase in torque when tapping 7 and 9 full threads deep is caused solely by chip accumulation. It reflects the increase in torque necessary to push these chips around to make them conform more or less to the available flute space and the flute shape.

In regard to hand tapping of stringy material, ordinarily, the flute space available for chips is that flute space right at the chamfer threads. It is seldom that stringy chips all fall down into the bottom of the hole or get pushed up beyond the chamfer when cut by a straight-fluted tap. Therefore, it is often a good policy, when a hand tap is used and chip accumulation is a potent factor in tap breakage, to increase the chamfer length. This will make available more flute length into which the chips might be packed.

I cannot allow this opportunity

SHOPMATES

N. Jarvis

... I SUPPOSE EVERY THING IS O.K. WITH YOU TOO ... NO PROBLEMS !!
YEP ! JUST FINE ... NOT A BIT OF TROUBLE ... NO SWEAT ... JOB'S GOIN' SMOOTH AS SILK !!
NO TROUBLE ANYWHERE AND THE WHIP'S MAD ??
WHEN HE HASN'T GOT ANY THING TO ROAR ABOUT HE DON'T FEEL NATURAL !!
N. JARVIS

He's mopping up the mess for the last time

At a leading aircraft research center, high-frequency vibration caused severe oil leakage from hydraulic lines servicing a huge wind tunnel. Many man-hours each month were wasted cleaning up the basement floor underneath, even though drip pans were used extensively.

Now, after a change to a Suntac oil, the vibration-caused leakage has been reduced to a point where "mop-up" is not needed. Hydraulic-fluid consumption has been cut by 4000 gallons a year. That's economy! That's Sun quality—the best economy of all.

If your plant is troubled with a leaky system, a Suntac antileak hydraulic oil can save you money, too. Ask your Sun representative to show you the Suntac desk-top demonstration, or write direct to SUN OIL COMPANY, *Philadelphia 3, Pa., Dept. AM-6 In Canada: Sun Oil Company Limited, Toronto and Montreal.*

SUNOCO

MAKERS OF FAMOUS CUSTOM-BLENDED BLUE SUNOCO GASOLINES

Announcing the Van Keuren
THREAD RING COMPARATOR

It does the job
FASTER and EASIER
than rings
AT LESS COST

If you use THREAD RING GAGES in your production line, the new VAN KEUREN THREAD RING COMPARATOR will dispense with many gages and much labor cost — in providing quick, accurate and repetitive measurements.

The Van Keuren Thread Ring Comparator is a production gage for checking external threads up to ¾" diameter.

Gages both full form and pitch diameter • Sets and checks quickly

Gives uniform results. Repeats to .0002" • Long lasting — has no pivots

Write for descriptive literature or call your nearest Van Keuren representative for demonstration. Literature is available covering our full line of Thread Gages and other measuring equipment.

VK

THE Van Keuren CO.
Since 1920
173 Waltham Street, Watertown 72, Mass.
PRECISION MEASURING TOOLS
. . . rated the world's most accurate
Plug Gages · Measuring Wires · Optical Flats and Light Wave Equipment · Gage Blocks · Precision Lapping Service and Parts

to slip by without saying something about fluteless taps. These taps, working on the principle of plastic deformation, cut no chips. Allowances have to be made for a torque approximately twice that required by cutting taps and for the fact that probably the top of the hole must be chamfered because of the burr thrown up by this type of tap. However, in the proper application, fluteless taps can eliminate troubles caused by chip accumulation and provide extremely good wear life.

John W Turton, *research engineer*
Greenfield Tap and Die
Greenfield, Mass

Test Your Writing

Dear Sirs:

I enjoyed very much the article entitled "Three ways to test your writing" (*AM/MM*—Mar 7 '60, p112).

Please inform me if copies of this article are obtainable and, if so, for how much.

W J Clough
Somersworth, NH

This article has been combined with another article, "How to organize your writing" (AM/MM—Apr 18 '60, p127), and the two are now available in a booklet called "How to Write Better Reports." Prices for the booklet are 50¢ per single copy, 45¢ per copy in lots of 100 or more—Ed.

"Now that you've decided to give me one more chance, how about a raise?"

CALENDAR

National Association of Metal Finishers—Annual Convention, July 22-24, Statler Hilton Hotel, Los Angeles, Calif.

American Machine Tool Distributors Association—Annual Meeting, Sept 3-4, La Salle Hotel, Chicago, Ill.

National Machine Tool Builders Association—Machine Tool Exposition, Sept 6-16, International Amphitheatre, Chicago, Ill.

Production Engineering Show, Sept 6-16, Navy Pier, Chicago, Ill.

Coliseum Machinery Show, Sept 7-15, Chicago Coliseum, Chicago, Ill.

Society of Automotive Engineers—Farm, Construction, and Industrial Machinery Meeting, Sept 12-15, Milwaukee Auditorium, Milwaukee, Wis.

American Die Casting Institute—Annual Meeting, Sept 14-15, Edgewater Beach Hotel, Chicago, Ill.

American Welding Society—National Fall Meeting, Sept 26-30, Penn Sheraton Hotel, Pittsburgh, Penna.

Instrument Society of America—Instrument-Automation Conference & Exhibit, Sept 26-30, Coliseum, New York, NY

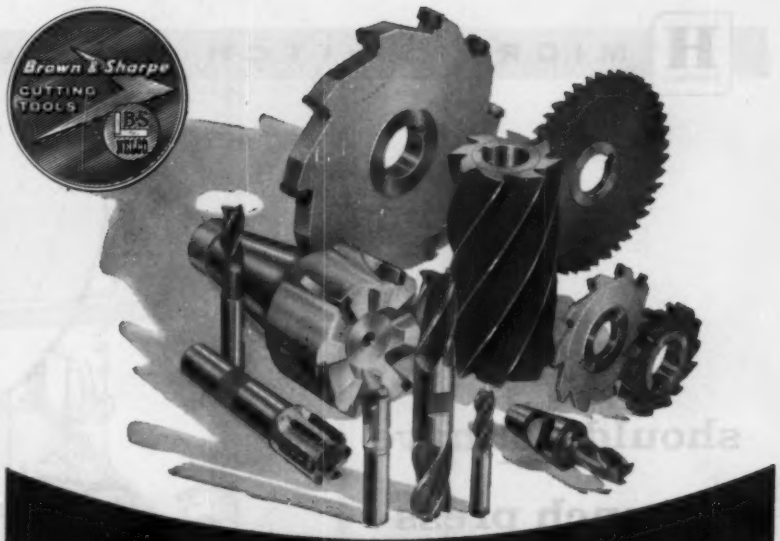
Pressed Metal Institute—Annual Meeting, Oct 10-14, Shawnee Inn, Shawnee on Delaware, Pa.

Society of Automotive Engineers—National Aeronautic Meeting and Display, Oct 10-14, The Ambassador, Los Angeles, Calif.

Industrial Management Society—Industrial Engineering and Management Clinic, Oct 13-14, Conrad Hilton Hotel, Chicago, Ill.

National Safety Council—National Safety Congress, Oct 17-21, Conrad Hilton Hotel, Chicago, Ill.

American Society for Metals—National Metal Exposition and Congress, Oct 17-21, Trade and Convention Center Philadelphia, Penna.



NOW *Brown & Sharpe* OFFERS THE ONLY COMPLETE CUTTING TOOL SERVICE!

The superiority of B&S Cutter Design gives you—

that *EXTRA* Edge in Production and pays off in 4 other ways that cut your metal removal costs.

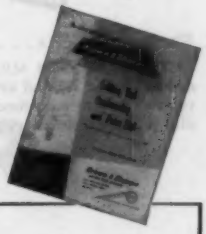
① World's Largest Line of Carbide, Carbide Tipped and High Speed Steel Cutting Tools for milling machines.

② Local Cutter Engineering Service—like having a B&S Cutter Engineer *in your own shop . . .* wherever you are.

③ Strategically located Cutter Maintenance, Modification and Regrinding Services.

④ Over 3000 "standards" stocked and sold by Industrial Supply Distributors in every city. Fast delivery ends wonder, worry and wait.

Send for the B&S "Condensalog" so you can order the tools *with the extras!*



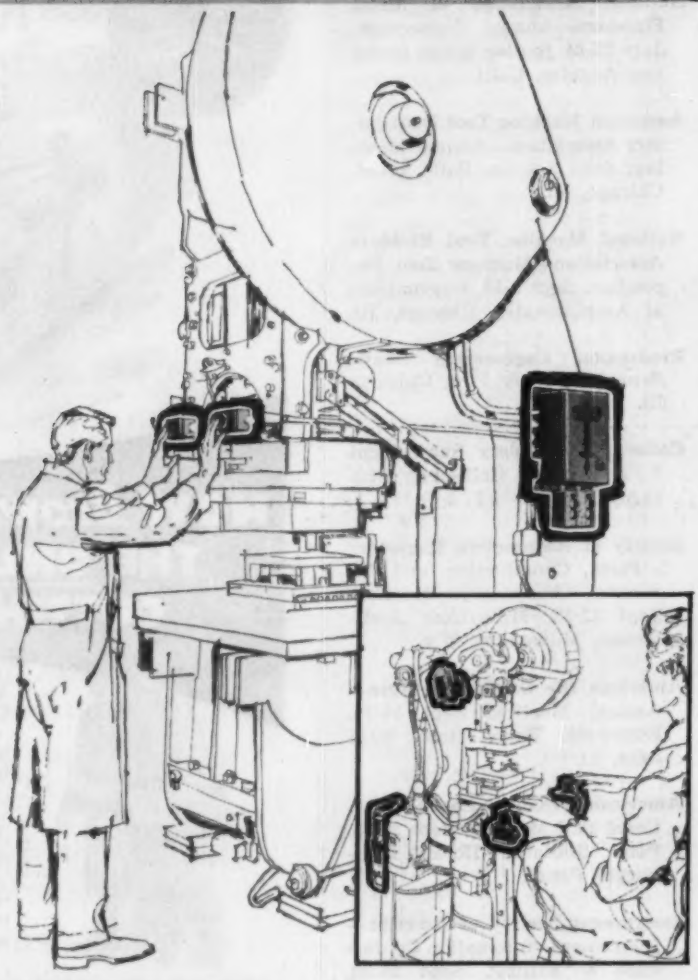
For that EXTRA Edge in Production

Brown & Sharpe

Cutting Tool Division
Brown & Sharpe Mfg. Co.,
Providence 1, Rhode Island

MICRO SWITCH Precision Switches

Why you should not have a punch press without MICRO SWITCH TRIP CONTROL



Packaged Kits . . . Low in Cost

Trip Controls from MICRO SWITCH start as low as $60.00 and are packaged in six simple, easy-to-wire models that fit virtually any punch press or paper cutter.

1. **You can increase production.** It's a matter of dollars and cents. Productivity of small bench presses as well as large OBI's will jump when Trip Control is installed. Finger-tip actuation of precision electric switches cuts operator fatigue, keeps production up even at the end of the day. Simple, direct operating motions let the operator continue a smooth, productive work rhythm. The switch does the work, particularly important in replacing awkward or heavy lever action that causes fatigue.

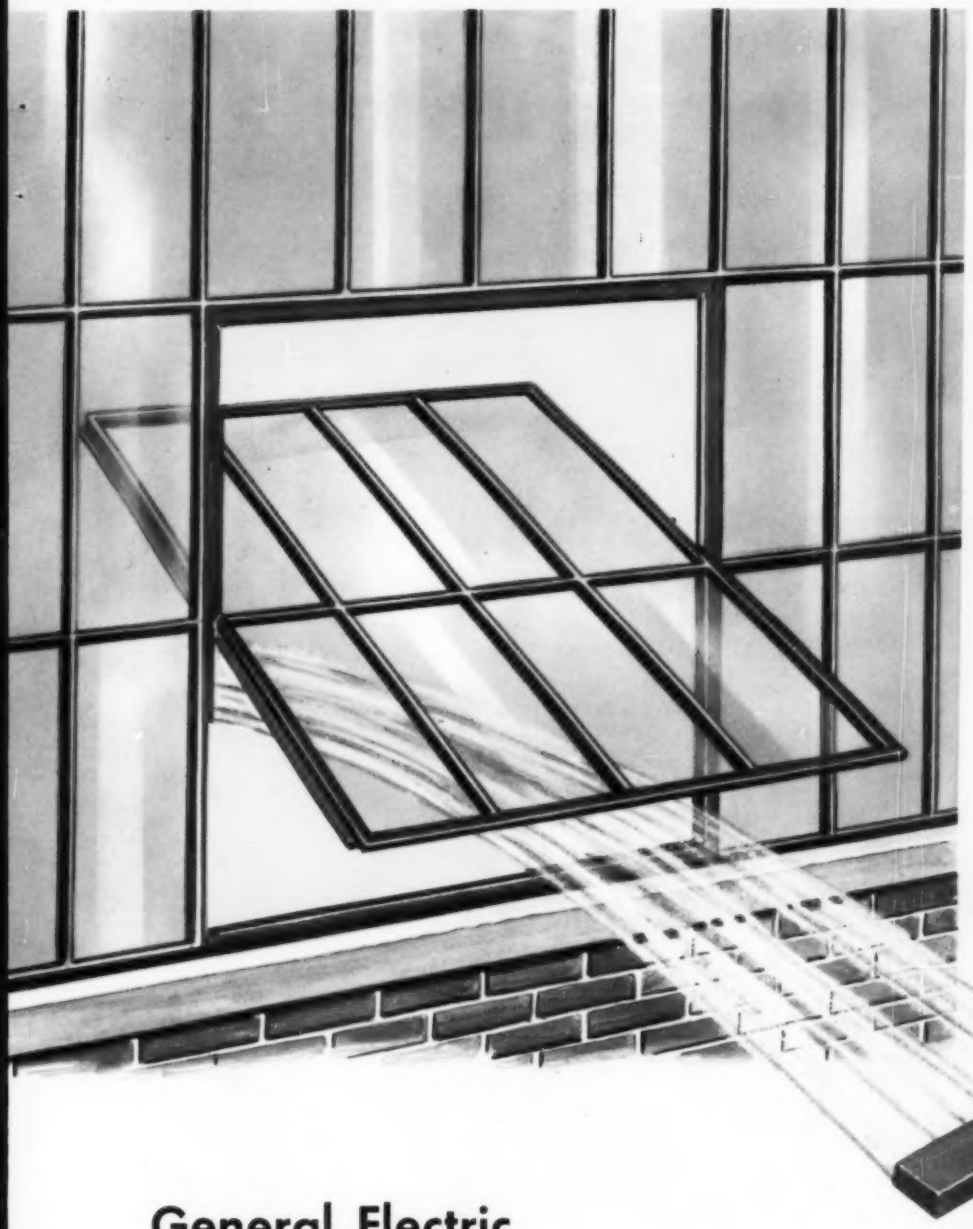
2. **TRIP CONTROL can't be cheated—even for the first stroke!** An exclusive feature of the MICRO SWITCH Trip Control is the "Can't Cheat" feature. It absolutely prevents the dangerous condition of an operator tying down or wedging one switch and then operating the control with one hand. Unlike other systems, Trip Control will not allow even one stroke under these conditions. An exclusive "Fail-Safe" feature prevents an accidental actuation of the clutch due to a faulty or damaged control component. Another exclusive protects die setters and maintenance men—and expensive dies—during set-up.

Ask about actual cases where Trip Controls increased production and raised employee morale. Your nearby MICRO SWITCH *branch office is listed in the Yellow Pages. Or write for revised Catalog 65.*

MICRO SWITCH . . . FREEPORT, ILLINOIS
A division of Honeywell
In Canada: Honeywell Controls Limited, Toronto 17, Ontario

Honeywell
MICRO SWITCH Precision Switches

Metallurgical Memo from General Electric



Now you can throw your hones out the window!

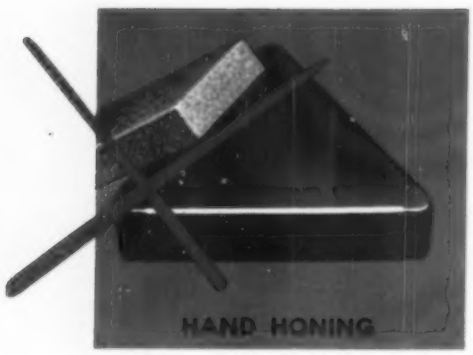
General Electric announces...

PRE-HONED CARBOLOY® INSERTS

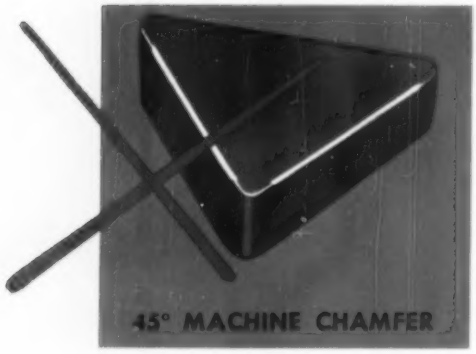
delivered ready to use

LOOK

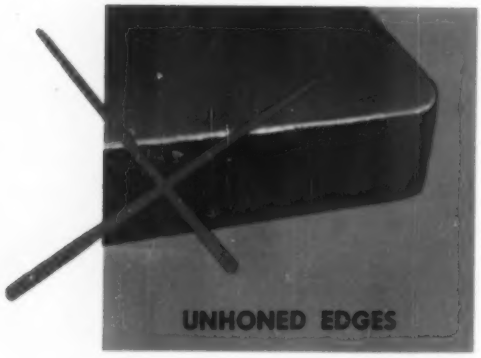
Now you get more lower cost per cutting edge



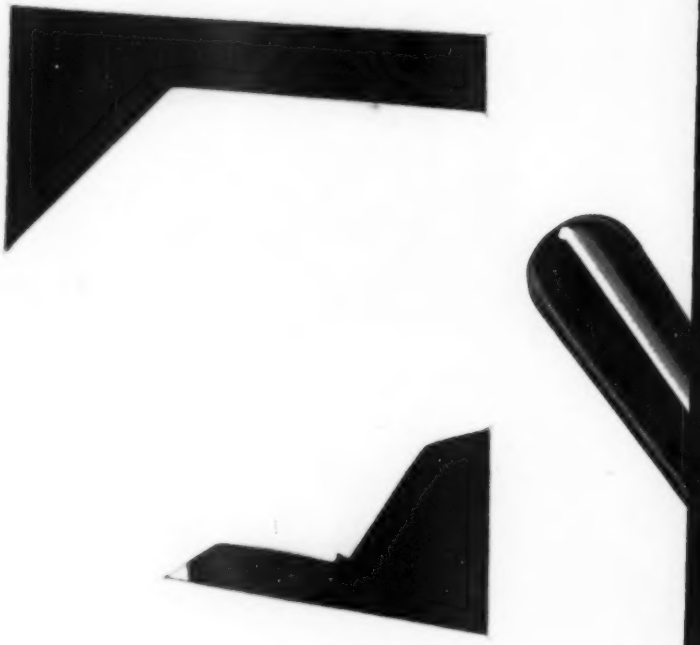
Hand-honing is inaccurate, time-consuming—often results in premature chipping and breaking.



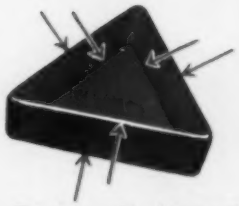
Chamfered, or ground-flat, edges are geometrically weaker than a radius and are more easily chipped or broken.



Unhoned or as-ground inserts show rough edges—result in unpredictable tool life due to chipping.



Pre-honed inserts with uniform, precise honed edges offer top strength; improve tool life predictability.



Because chipping and breaking are minimized, pre-honed Carboloy inserts result in lower cost per cutting edge.

Additional savings result through the elimination of costly and often inaccurate hand-honing methods.

predictable tool life...
...no hand-honing cost!

Delivered ready-to-use...
honed to a precise radius...
promise BETTER PROFITS
THROUGH BETTER TOOLING

Now General Electric Carboloy® inserts are pre-honed *at the factory!* Here's what it means to you:

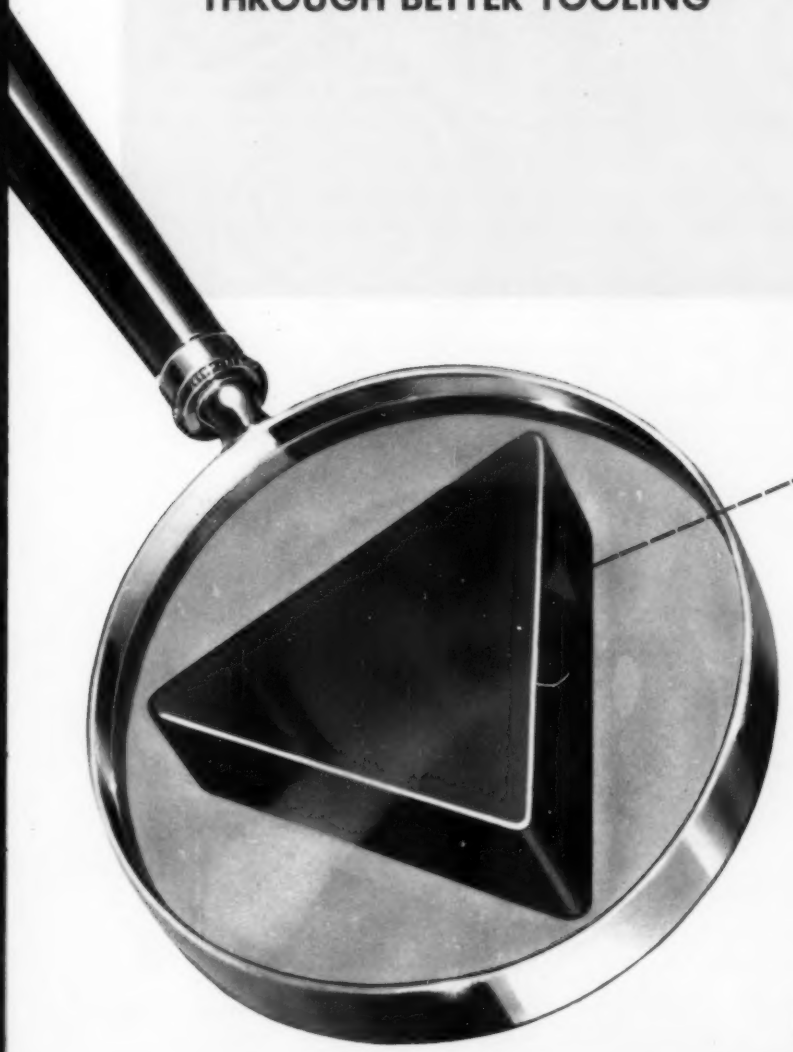
1. An insert with edges honed to precise *radii* gives the strongest geometric shape to withstand cutting pressures. This reduces the chance of chipping—increases the predictability of tool life. Hand honing *cannot* achieve precise radii—G-E pre-honing can . . . and does!

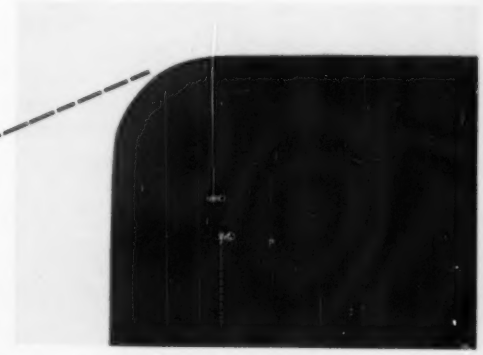
2. Since chipping is minimized, fewer cutting edges are wasted. The result is lower cost per cutting edge.

3. Since inserts come pre-honed and ready-to-use, the labor cost and inaccuracies of hand honing are eliminated. This more than offsets the additional charge for pre-honing.

4. Pre-honed Carboloy cemented carbide inserts have standard edge radii honed to a greater or lesser degree, depending on the job to be done. You'll *know* the honing is right!

Ask your Authorized Carboloy Distributor about pre-honed Carboloy inserts, convertible seats, toolholders, and brazed tools. Or, write directly to: *Metallurgical Products Department of General Electric Company, 11173 E. 8 Mile Road, Detroit 32, Michigan.*





Shown here, both under magnification and graphically, is an edge of the new Carboloy pre-honed insert. Radius is geometrically ideal to minimize chipping, extend tool life many times.

CARBOLOY®
CEMENTED CARBIDES

METALLURGICAL PRODUCTS DEPARTMENT

GENERAL ELECTRIC

And the proof of the honing is in the saving!

Here's how the Dayton Steel Foundry Company uses Carboloy pre-honed inserts to machine cast steel truck wheels . . . at a savings!

Faced with increasing production, labor, and machining costs, the Dayton Steel Foundry Company had to economize without sacrificing quality.

A true, in-plant comparison between unhoned inserts and the new Carboloy pre-honed inserts was undertaken . . . and here's what happened:

Machining truck wheels of cast steel (AISI 1022 to 1032)—with a Brinell hardness of 140 to 190—required feeds from .015″ to .019″ per revolution; speeds from 280 to 320 fpm. Cuts varied from ⅛″ to ⅜″ and were interrupted on the O.D. turning of the spokes.

It was found that a pre-honed insert produced 85 pieces before it had to be indexed; showed wear only—*no chipping*. An ordinary unhoned insert produced only 40 pieces before *chipping and breaking*.

In *all* operations, it was reported pre-honed inserts provided 30% to 35% greater tool life over unhoned. Too, the need for hand-honing by the tool crib man has been eliminated—savings are estimated at 10c per insert, which more than offsets the additional cost of pre-honed blanks. Besides this, the tool man is freed for more productive work. Finally, the use of pre-honed inserts makes certain that no insert will get on the job without honing.

Make your goal "BETTER PROFITS THROUGH BETTER TOOLING"! Check with your Authorized Carboloy Distributor. He's listed in the Yellow Pages. *Metallurgical Products Department of General Electric Company, 11173 E. 8 Mile Road, Detroit 32, Mich.*

Tops in Tooling Quality

From the research and quality-control facilities of the Metallurgical Products Department of General Electric comes the outstanding quality tooling line in the metalworking industry. The new Carboloy pre-honed inserts, as well as the complete line of Carboloy toolholders, inserts, insert seats, convertible seats, and brazed tooling, are designed to meet every tooling need efficiently and economically.

CARBOLOY
CEMENTED CARBIDES

METALLURGICAL PRODUCTS DEPARTMENT

GENERAL ELECTRIC

CARBOLOY® CEMENTED CARBIDES
MAN-MADE DIAMONDS • MAGNETIC MATERIALS
THERMISTORS • THYRITE® • VACUUM-MELTED ALLOYS

SPOT NEWS...

- **Electron beam welds 20 to 30 feet long may be used on the B-70 bomber** at North American Aviation. Reports suggest that, because of the size of the components and the need for maintaining a vacuum in the welding chamber, a series of airlocks (or an equivalent system) will be necessary for successful operation.

- **Russians have bought 15 small high-speed lathes from Mitsubishi Shipbuilding** (Japan). Three-man mission headed by I J Timofeev, president, Stanko Import (Machine Tool Import Corporation Soviet Government), made the purchase. Prospects are for sale of several hundred in near future.

  Going to the Machine Tool Exposition? *If so, you can save yourself a lot of time and trouble by getting a copy of the NMTBA's Visitors' Information Booklet. It gives full information on dates, hours, transportation, hotel rooms (they're going fast), registration, and the Inquiry Time Saver plate. Booklet is available from the National Machine Tool Builders' Association, 2139 Wisconsin Ave., Washington 7, D.C., or circle No. 50 on the Reader Service Card in this issue.*

- **Precoating metals with a copper or aluminum spray prevents oxidation** and material loss during thermal treating, reports Chance Vought's Aeronautics Division. Spray produces an oxide coat which protects the metal part from damage during heat treatment or hot forming. Loss of material is held to 0.0001-0.005 in. Uncoated, material loss runs as high as 0.012 in. Precoat also acts as a lubricant for forming, is easily removed.

- **Six-man coordinating committee on standardization** of general-purpose machine tools has been formed. Three members represent users: Robert Witsche, International Harvester Co; H Cooper, Chrysler; and Col Wiley, Department of Defense. Three members represent builders: Swan Bergstrom, Cincinnati Milling Machine Co; Walter Bailey, Warner & Swasey; and a third member from a firm not a member of NMTBA. Indications are that the committee will first study the standardization of milling machines.

- **Ceramic-like resins capable of resisting temperatures of 1000 F** with excellent shock properties are now undergoing tests in England. Expected applications include missiles, high-speed aircraft, and nuclear-fuel-element cladding.

- **A "trigger" contract for ten Auto-Cycle precision boring machines,** each with solid granite baseplate, has been awarded to Industrial Machinery Division of American Electronics Inc, Norwood, Mass, by General Services Administration, Department of Commerce. Machines have 6-in. swing, 6-in. travel.

- **Output of plastics will hit 6.4 billion pounds this year,** up from 5.6 billion pounds in 1959, according to industry analysts.

- **Tungsten, in single-crystal form, is machinable at room temperature,** ductile, and extremely pure. Linde is producing single-crystal tungsten and other refractory materials through an arc fusion crystal-growing process (see p111). Westinghouse Lamp Division, Bloomfield, NJ, produces single-crystal tungsten through electron-beam zone refining. Dr R H Atkinson, at Westinghouse, says the latter technique is still a laboratory tool, but sees no reason why single-crystal bar stock couldn't become an engineering material.

- **Explosive forming of superalloys and refractory metals while they are hot** is under study at Ryan Aeronautical Co, San Diego. Biggest problem is finding suitable media for transmitting the energy. Water obviously won't do for hot forming. One possibility, says Ryan, is small glass beads.

RELIABILITY:

Reason enough to buy LeBlond

Valuable as five fingers on a hand, these five great LeBlond lathes run round the clock, year in, year out, at the Warren, Ohio, shops of Wean Manufacturing Co. Wean has six LeBlonds in all, including the five in the picture, all purchased in the last five years.

The operations they perform are typically job-shop. Lots are small—five parts alike are a big run; materials may vary from hardened steel to copper. Fat mill rolls, long whippy spindles, sturdy stepped shafts—the rugged LeBlonds take them as they come and turn them quickly and accurately, regular as clockwork.

Much of Wean's output goes into steel mill equipment that can be relied on to hold up under the most exacting requirements—the same steadfast degree of reliability that LeBlond lathe customers expect, and get.

RELIABILITY is a good reason to buy a lathe. It is reason enough to buy LeBlond.

See LeBlond Booth 810 at the Machine Tool Exposition in Chicago, September 6—16. MMT-PE

THE R. K. LeBLOND MACHINE TOOL COMPANY
Cincinnati 8, Ohio

LeBLOND *of Cincinnati*

WASHINGTON...

Defense boost to be reined in . . .

The fiscal 1961 defense appropriation, now in the final stages of the Congressional wringer, will be larger than the Administration's request. But as the situation now shapes up, the increase will be nowhere near the massive sums Senate leaders were talking about ($3 billion or more) right after collapse of the Summit talks in Paris.

The Senate Appropriations Committee has approved a money bill slightly more than $1 billion over the Pentagon's initial budget plan; the House passed an appropriation only $122 million higher.

In each case, there was a major reshuffling in spending plans for hardware procurement and development. Still in doubt are the projects to be favored in the Congressional increase.

How weapon projects stack up . . .

The Senate Committee hiked funds for North American's B-70 from $75 million to $360 million. The House didn't change the project, is likely to accept much of the Senate Committee's increase. Enough extra will probably be okayed to allow resumption of some subsystem development work—by IBM, Westinghouse, Motorola, or others—cancelled in last year's economy move.

The Senate Committee also restored $294 million for the Boeing-Westinghouse-Marquardt Bomarc B missile killed by the House, failed to go along with the House addition of $215 million for Convair F-106 fighters. This puts the lawmakers in the unusual spot of resolving the comparative merits of a missile and a manned plane for air defense.

Among the other important Senate Committee additions: $200 million to buy Douglas and Boeing jet transport planes (the House tacked on $250 million); $241 million for extra Polaris submarines (the same amount added by the House); $83.8 millon for Lockheed's Samos reconnaissance satellite project (the House added $54 million extra for three Lockheed satellite projects).

The Senate Committee also voted back $293 million for an aircraft carrier and $400 million for general military hardware procurement—sums previously knocked out by the House. It also turned down the House's $20.7-million boost for Boeing's Minuteman ICBM and the Air Force's post-Summit proposal to jack up Convair's Atlas ICBM production by 24 missiles, and trimmed back increase voted by the House for anti-submarine warfare and for stockpiling parts for an airborne bomber alert.

Atomic power development snagged

Development and construction of seven or eight atomic powerplants—the equipment and facilities aimed to keep the U S in the world lead on atomic power—have been snagged by a U S Court of Appeals decision.

The Court found that AEC is misreading the atomic law when it allows a firm to begin construction before the Agency certifies the finished plant would be safe to operate. Purpose of AEC's procedure is to allow a plant to start operations faster by saving industry up to five years lead-time to perfect design and safety features. Under present AEC policy, the company still needs a separate operating permit before the reactor can be turned on.

Involved in the court case is PRDC's $55-million plant outside Detroit, now about 60% completed. Three labor unions convinced the Court that the law requires a decision on safety before the construction permit is granted. AEC is expected to appeal the decision to the Supreme Court.

Aerospace industry profits down . . .

SEC reports that aerospace industry earnings dropped to a new low in 1959—1.5% of profit on sales. This compares, Aerospace Industries Association claims, to an average 4.5% of profit to sales for manufacturing in general.

AIA says the industry's rate of profit to net worth was also below average last year—8% compared to a general manufacturing industry average of 9.6%.

Squabble over patent reform . . .

Efforts to clarify policy on patent rights in government contracts are stalled. The only legislation moving through Congress as the session goes into its final days is a House-approved bill to grant NASA flexibility on whether or not to allow contractors to patent ideas invented on Agency contracts.

Right now, NASA's patent policy is more restricted. It mirrors AEC's, which generally bans contractors' patent rights in the commercial field.

The liberalized NASA provision, however, still falls short of the Defense Dept policy allowing contractors patents for commercial exploration (no questions asked) as long as the Pentagon retains royalty-free use of the patent. The revised NASA law also provides for free government use of private patents stemming from government-financed research.

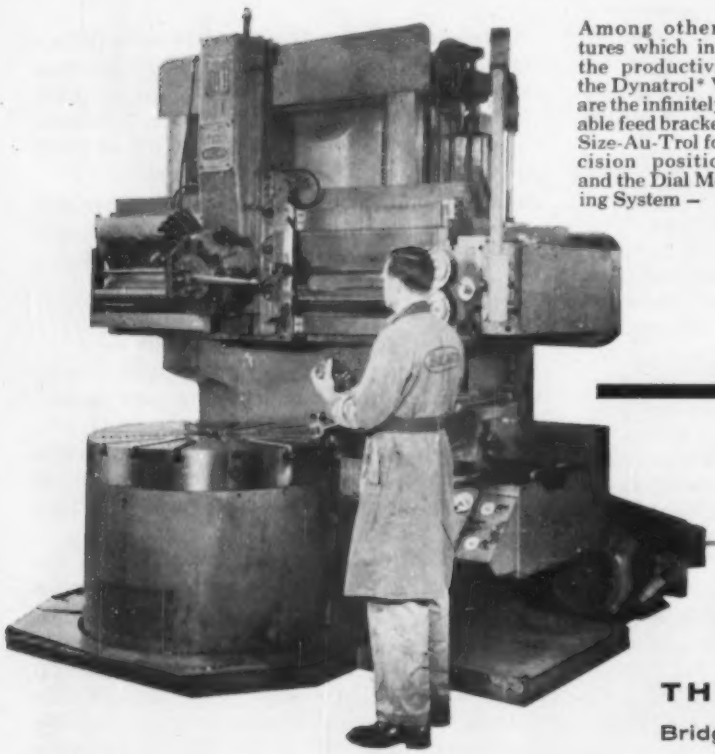
FINGER-TIP CONTROL

Increases Productivity of...

BULLARD

DYNATROL*
VERTICAL TURRET LATHES

Directional control of all head motions in feed on traverse, either horizontally, vertically or at any 45° angle, as well as table start and stop from a lightweight portable pendant, is a distinct production advantage.



Among other features which increase the productivity of the Dynatrol* V.T.L. are the infinitely variable feed bracket with Size-Au-Trol for precision positioning, and the Dial Measuring System –

It allows the operator to always be in the most advantageous position in relation to the work and eliminates the necessity of climbing for buttons or levers. By reducing operator fatigue and increasing his efficiency, more metal is removed per hour with a lower cost per piece.

*TRADE MARK

ask your Bullard Sales Engineer for the complete Dynatrol story or write for catalog.

THE BULLARD COMPANY
Bridgeport 9, Conn., Telephone EDison 6-2511

YOU CAN'T BEAT A BULLARD

CIRCLE 231 READER SERVICE CARD

TRENDS

DETROIT...

Outlook rosy...

An orderly, staggered changeover period seems ahead for the auto industry, if a third quarter schedule of about 1,150,000 passenger cars holds. The total will be made up almost evenly of 1960 and 1961 models.

Typical of the planning is Ford's. Production of current Lincoln and Mercury cars is expected to end June 24, while Falcon will be continued through August 31. Dearborn-based assembly of standard-size Fords will end August 12.

Even before these dates parts and component plants will be building up and shipping inventories of 1961-model ingredients. Public introduction of the new Ford products will center around September 12, the date when 1500 citizens of Flora, Illinois, will be driving the cars in a giant, one-week-long test program.

Sales are up...

The month of May chalked up the best auto sales record since September 1955. All but a few makes were selling strongly, and a few all-time records were set.

Cadillac, for example, delivered 66,913 new cars during the first five months of this year, beating by 1496 units the previous mark set in 1959. Chevrolet produced its millionth car of the year on June 6, a date 34 days ahead of the old industry mark on July 13 which was also set by Chevrolet in 1955. 14% were Corvairs.

Chrysler retail sales are up 47% over 1959, giving that company a 16% share of the market. This company's strength stems from strong demand for Dodge's Dart and the Valiant.

May sales of Dodges totaled 37,898 for a whopping 148% hike over 1959's rate. Only three times before has Dodge's monthly total exceeded 37,000 units, and these periods were all in 1950.

Impact of Compacts...

A somewhat bemused release from Ford Motor Company is of interest because of the facts it contains, and also because of some facts left out.

It says, first of all, that the Falcon and the Comet, between them, are outselling all foreign makes imported into this country by a plurality of about 10,000 units since the first of the year.

Although the Falcon has yet to celebrate its first birthday, Ford's figures show that it is leading the compact car field in sales, and, in addition, claims to have captured third sales place in the industry. This latter claim is hotly disputed by Plymouth, Dodge and Rambler.

The Plymouth people say, in a release dated June 12, that its registrations of 149,272 cars for the first four months of 1960 put it in "solid third place." However, in the next breath the release adds that Valiants account for 36% of this total. The standard-size Plymouth, historical occupant of third place, is obviously hurting.

Plymouth's figures, were, of course, counted by Plymouth employees, but they do not stack up with Dodge figures as counted by Dodge people. Dodge's five-month total for retail deliveries is 161,272 units. Plymouth, by its own admission sold 42,672 cars in May (44% Valiant this time) but if you deduct a total of 82,514 Valiants, Plymouth trails badly with 109,430 genuine Plymouths delivered.

Ford says Falcon sales through May 31 were 194,600 units. Rambler counts 188,116 cars sold for the same period. But, a spokesman adds, we made 225,982 Ramblers in these five months. Someday, obviously, these must be sold—so who's in third place?

A Ford spokesman refused to divulge standard-size Ford retail sales as of the end of May. But on the basis that they must eventually be sold, 485,000 units were produced in this period, down a saddening 225,000 units from 1959, with a 50-day supply in dealers' hands. About the only compact car not hurting anyone—either its competition or its sponsor—is Corvair.

The stylist's pad...

Automotive stylists are occasionally eccentric in manner, and a few even sport beards, but they do not live in one-room garret apartments or wear blue-jeans.

With all of this in mind, it is interesting to note their off-beat, strictly cool trade jargon which has not as yet found its way into Webster's. For example, "Pizazz" means give it everything like on Cadillac tailfins. "Pork chop" stands for the forward bottom-half of the front door cut. "Ipsipipsi" denotes correct dimensions.

The "Ivory tower" is the place where they work. "Hairy" denotes a car such as the Chrysler 300 which has an excess of power, or it could also be called "Gutty". Depending upon the user, "Gasarooney" can mean either terrific, overpowering, or weird. The "Dutch Man" is the metal panel that runs across the rear deck between the back-lite and the deck lid. (For the uninitiate, the back-lite is the rear window of a car.)

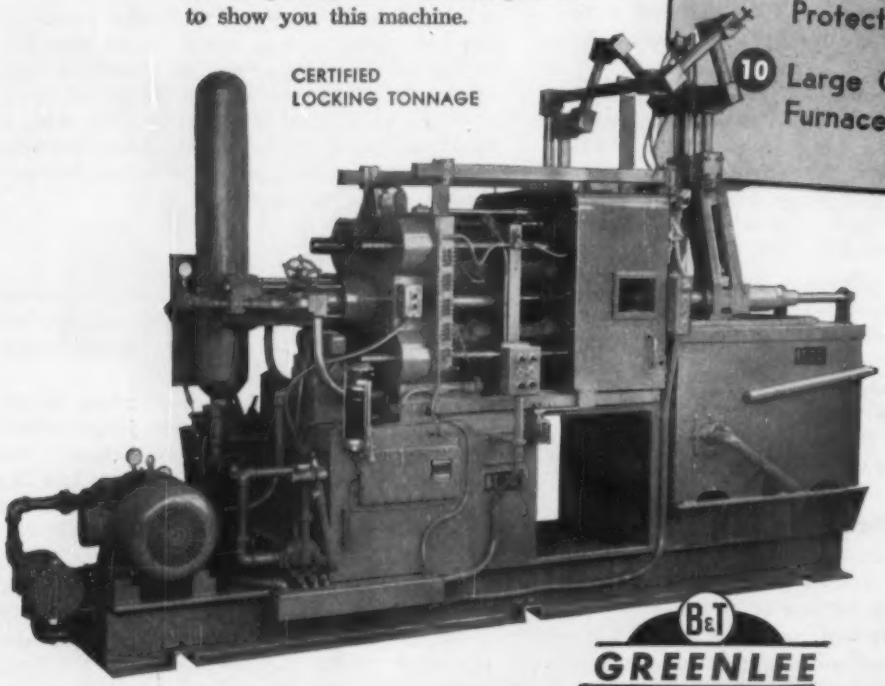
"Blurps" are bumps, and with that we close.— ***Don MacDonald***

10 big reasons why B&T offers you a superior AUTOMATIC ZINC DIE CASTING MACHINE...

The extra strength and precision built into B & T Die Casting Machines gives you thousands of hours of trouble-free operation . . . helps you to increase production and reduce operating costs.

See this B & T Automatic Hot Chamber Die Casting Machine in operation. Look it over. Note the motorized die height adjustment, automatic die lubrication, large conveyor area for automatic part removal, and many other advantages that really pay off on the production floor. Your B & T representative will be glad to make all arrangements to show you this machine.

1. Extra Built-in Beef and Rigidity.
2. A Precision Machine.
3. Four-Toggle Locking Linkage.
4. Massive Tie-Bars.
5. Heavy, Rigid Platens.
6. Automatic Lubrication.
7. Motorized Die Height Adjustment.
8. Automatic Die Lubrication.
9. Low Pressure Closing System Protects Dies.
10. Large Capacity Furnace.



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A Complete Line of Hot and Cold Chamber Die Casting Machines
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B & T MACHINERY COMPANY

A DIVISION OF GREENLEE BROS. & CO.

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AIRCRAFT and MISSILES...

TRENDS

Weapons system management...

The Air Force is revising its policy for management of weapon systems in the missile and aircraft field (*AM/MM*—June 13 '60, p91).

Systems engineering and technical direction will be assigned to development or production prime contractors through competition.

Space Technology Laboratories' role will be taken over by the new, non-profit Aerospace Corp, which is being set up along the lines of the Rand Corp.

The tentative charter for Aerospace Corp sets forth these functions: Advanced planning and evaluation of new ideas in missilry and astronautics systems; "broad-brush" initial system design; technical evaluation of contractor proposals; and technical monitoring (as distinguished from the technical "direction" STL has furnished) of projects as they reach the hardware stage.

The new switch stems from recommendations by an Air Force advisory committee to the effect that manufacturing contractors are now experienced enough to compete for systems engineering and technical management for future space-age weapons systems.

The committee, headed by Cal Tech's Dr Clark B Millikan, said that the Air Force still needs the full-time backup of a civilian, talent-laden organization with specialized brainpower to do advance planning and evaluation of later-generation missile and space systems.

Under pressure from the GAO and Congress, the Air Force has decided this organization should be a non-profit corporation with no ties to conventional manufacturing companies.

Solar power study contract...

A Phase 1 contract leading to development of a flight prototype of a 15-kw solar-mechanical space auxiliary power unit capable of operating continuously for one year has been awarded by the Air Force to the Turbo Division of Sundstrand Corporation.

Sundstrand says that this is a state-of-the-art advancement project, rather than an effort to get an operational unit as soon as possible. Therefore, new approaches are being tried in many areas to establish feasibility. Total weight of the unit, as Sundstrand now sees it, would be 900 lb or less.

The company estimates that it would take a program lasting five years, costing about $12 million to obtain a system for flight that would have enough promise to justify the cost of using a booster to put it in space.

Boeing to build hydrofoil...

After many years of research studies, the Navy has awarded its first contract for construction of a hydrofoil vessel. The contract, valued at about $2,082,000, goes to Boeing Airplane Co, lowest of eleven bidders on the project. J M Martinak Shipbuilding Corp, Tacoma, Wash, is an associate contractor to Boeing.

The vessel will be used to test the feasibility of hydrofoil patrol craft for coastal anti-submarine operation. Hydrofoil boats achieve high speeds by skimming along the water on foils protruding from the sides. The Maritime Administration has ordered a 60-ton model from Grumman for tests as a ferry boat.

The Boeing vessel will be 115 ft long and displace 110 tons. Two 3000-hp gas-turbine engines will provide propulsion when the vessel is foil-borne. The vessel will also be equipped with an auxiliary 600-hp diesel engine. Top speed when foil-borne will be 45 to 50 knots. The Navy wants to build vessels of 200 tons or greater later on.

Aircraft and missile strikes...

At press time, here was the situation on the aircraft and missile strikes which broke out earlier this month:

- **Convair**—Negotiators for the IAM and Convair, after a strike lasting eleven days, reached agreement on a two-year contract affecting some 20,000 workers. IAM workers at Cape Canaveral settled their nine-day strike.
- **Lockheed**—About 13,000 IAM members were striking at four Lockheed installations. Negotiations were still going on.
- **Douglas**—The UAW and Douglas settled for a two-year contract calling for a four cents an hour cost-of-living increase this year and a seven cents an hour basic-wage increase next year. This affects about 22,000 workers. Negotiations with the IAM, covering 18,000 workers, were still in progress.
- **United**—Governor A A Ribicoff asked both union and management representatives to meet with him in an effort to settle the strike which began June 8. Some 30,000 IAM and UAW workers are involved. The company's Sikorsky, Hamilton-Standard, and Pratt & Whitney divisions, seven plants in all, have continued to operate. Negotiators have been stalemated on demands for a union shop and automatic, instead of merit, pay increases.

BULLETIN NO. PO-66D

CUSHMAN

George - This looks like the answer to our problem. Have their rep. come in.
HRB.

air operated CHUCKING EQUIPMENT

- INCREASES PRODUCTION
- LOWERS COSTS
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THE CUSHMAN CHUCK COMPANY • HARTFORD 2, CONNECTICUT

MACHINE TOOLS...

Licenses for export to Russia...

A license to export around $6 million of transfer machines from this country to Soviet Russia has been granted to a leading U S machine tool company, despite the U-2 rumpus.

This license is on top of two other export licenses that have been approved by Washington for grinding machines valued at about $2 million.

This action does not mean that U S builders have actual orders in hand from Moscow or from companies in Europe responsible for purchasing tools for Moscow. It merely indicates that the builders have, in effect, been given "hunting licenses" to go after business with assurance that if they get the orders, the government will let them ship the machines.

Securing a shipping license from Washington and getting the Russian business are two separate things. It may even be that the former is easier than the latter, because the Russians are being courted by a lot of west European builders.

Several American builders have been seeking Russian machine tool business for some time.

Ferracute buys Farquhar line...

Ferracute Machine Co, Bridgeton, N J, has bought the complete line of Farquhar hydraulic and mechanical presses from the Oliver Corp. Farquhar has made machinery in York, Pa, for more than 100 years and had developed its press business during the years. It recently has been a part of Oliver, which principally makes farm machinery. Ferracute has been in business nearly a century and was a pioneer in mechanical presses.

Onsrud diversifies further...

Onsrud Machine Works Inc, Chicago, has purchased the Hydraulic Press Division of the Berthelsen Engineering Works Inc, Joliet, Ill. This division makes heated-platen single and multi-opening presses for laminating plywood, reconstituted board products, metal, plastics and rubber. Manufacturing and sales will be handled by the newly-formed Onsrud Berthelsen Hydraulic Press Division.

This acquisition is a part of Onsrud's program of diversification which now includes machine tools, woodworking machinery and portable tools.

Export study well along...

Study of the machine tool export situation by the Metalworking Equipment Division, Business and Defense Services Administration, Department of Commerce, is well in hand. It will be completed and sent to the Office of Civil and Defense Mobilization by August 1.

This study is part of a broad program devised by an inter-agency governmental committee at the request of OCDM's administrator. The program stems from a 26-page letter submitted to OCDM by the machine tool industry in September 1959 setting forth the critical problems facing the industry.

The most important single part of the program —a study of machine tool obsolescence—has not yet got under way. It was delayed for a while by changes in top personnel in BDSA.

Common Market tariffs going up...

Tariffs ranging from 6% to 12% on machine tools imported into the European Economic Community (European Common Market) are being proposed to become effective on January 1, 1973. They will be subject to negotiation, however, in the GATT conferences beginning in September.

Milling, sawing and drilling machines will bear a 12% tariff, lathes 10%, boring machines and planers 8%, jig borers 6%, presses 12%, cylindrical gear cutting machines 10%, other gear cutting machines 6%, forging machines 6%.

Grinding, burring, milling, polishing and straightening machines, machines for surfacing, and machines for working with the help of grinding wheels, abrasives or steel polishing will be taxed at 10% if they have a micrometric system of measurement. Without such a system the duty will be 4%.

Electric machines and equipment for welding, brazing and cutting will have a tariff of 15%.

Rates, as finally amended, will be put into effect in three equal steps, the first about January 1, 1961. France and Italy, with high rates now, will begin lowering their rates in three steps starting next January, but Germany and the Benelux countries, with lower rates, will begin raising theirs.

This information about proposed tariffs has become available through translation of official documents by the Metalworking Equipment Division of BDSA.

BF.

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TRENDS

MATERIALS...

Cobalt-containing steels...

Mellon Institute's new high-strength steel, a cobalt-modified SAE 4137 grade, provides ultra-high strength, good ductility, low notch sensitivity, good welding characteristics, and easy formability.

Tests on full-scale rocket-engine cases show that the alloy, designated MX-2, can be used in designs requiring yield strengths of 225,000 to 235,000 psi. Universal-Cyclops Steel Corp is producing this alloy commercially under the tradename Unimach UCX-2. It is expected that this alloy is only one of a new series to result from the Mellon research into cobalt additions. Composition of MX-2 is, in percent:

C	*Mn*	*Si*	*Co*	*P*	*S*	*Cr*	*Mo*	*V*
0.39	0.70	1.00	1.00	0.01	0.01	1.10	0.25	0.15

Another new cobalt-containing steel, still under development by The International Nickel Co provides high strength with reasonable ductility and toughness by conventional oil quenching and tempering. Mechanical properties obtained with this alloy after oil quenching and tempering at 600 F for 10 hr include: 0.2% offset yield strength of 295,000 psi; ultimate tensile strength 340,000 psi; elongation 11%; reduction in area 29%; charpy V-notch impact strength—18 ft/lb at 80 F. Composition, in percent, of this alloy is:

C	*Mn*	*Si*	*Co*	*P*	*S*	*Cr*	*Mo*	*Ni*	*Al*
0.55	0.40	1.90	2.9	0.010 max	0.010 max	0.90	0.50	1.85	0.05

Alloy binders for carbide...

Substitution of nickel for part of the iron in the binder for tungsten carbide improves the strength and hardness of carbon compacts, concludes an U S Army metallurgical report published by the Office of Technical Services, BDSA, U S Dept of Commerce. A survey to evaluate binders of alloy systems having low strategic index (readily available in the US), as compared to cobalt, is described in the report. Cobalt appears to have no equal.

Tungsten carbide prepared with alloy binders in certain ranges was not as strong as straight cobalt-bonded tungsten carbide. However, binder alloys of cobalt-iron and cobalt-iron-nickel proved suitable for operations where extreme hardness was a critical requirement and high transverse rupture strength was only secondary. (Not for interrupted cuts.) Also noted was an inverse linear relationship between hardness and strength, and a positive linear relationship in the slope of the strength-hardness curves.

Oxygen key to magnetic annealing?

Soft magnetic alloys of nickel-iron (such as Permalloy) and nickel-cobalt-iron (such as Perminvar), when heat-treated in a strong magnetic field, as by induction processes, tend to become permanent magnets. This alignment of their magnetic moments, called "uniaxial magnetic anisotropy," has puzzled metallurgists and scientists for years. Because the Bell Telephone System uses large quantities of these alloys for inductor cores, Bell Laboratories scientists have studied the phenomenon.

One indication of the study is that magnetic polarization does *not* result when these alloys are heat-treated in a field unless about 14 parts per million (ppm) of oxygen are present in the alloy. Magnetic strength varies very little between 14 and 20 ppm, and even larger quantities of oxygen appear to cause little change. Substantially greater amounts of oxygen may form oxides of the constituent metals. Best guesses so far are that the oxygen atoms settle on a plane of metallic atoms in a crystal and displace the next parallel plane of atoms. When enough oxygen atoms are present, the alloy can be magnetically oriented by heat treatment in a magnetic field.

Practical application of this discovery may be in producing more uniform magnetic materials by more closely controlling the quantity of oxygen present in the alloy.

Low-energy isotopes...

Four radioisotopes are being developed into practical tools of industry and medicine by the General Motors Research Laboratories physics department. Three isotope sources are new — Samarium 145, Samarium 153, and Gadolinium 153. The fourth isotope, Thulium 170, is commercially available but, until now, has had packaging limitations.

For sealed sources that emit pure gamma or x-radiation in the low-energy range of 30 to 100 kev (1 kev = 1000 electron volts), these four isotopes show promise. Typical industrial applications include gaging and inspection radiography. Isotope radiography is just like x-radiography, except that isotope equipment is a fraction of the cost of conventional x-ray equipment. Isotope equipment is portable, even to the extent of requiring less shielding. Total weight of Sm-153 exposure unit is 18 lb. Its size and weight provide ease of manipulating and positioning; it can be combined directly with tooling such as jigs and fixtures.

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WHAT'S AHEAD... in Metalworking

TRENDS

Metalworking production again on the rise...

Metalworking production as measured by the AM/MM index has risen to 108 (1957 = 100), reflecting gains in automotive and machinery production. Many other metalworking fields report brightening outlooks.

Gearmakers expect continued good business through the remainder of 1960, according to a consensus of AGMA members attending their annual meeting. Bookings for the first half are about 10% higher than in the first half of 1959, and no sharp change is expected in the second half.

Bearing manufacturers report good, steady business. Several companies are up 10% over last year at this time, and they anticipate a 10% gain for the year as a whole. Backlogs are steady. One manufacturer reports that prices on certain size ball bearings will go up anywhere from 2 to 14% around July 1.

Cutting tool sales show a strong upswing. Three firms report that June sales are 15 to 20% higher than in June 1959. One company, however, expects a sales slump this summer. Another says a price increase could be anticipated sometime around October of this year.

Sheetmetal industries report business steady. One fabricator's sales are up 25% over this time last year and he anticipates a 10% sales increase for the year but a 10% drop in profits. Another firm reports business down 10% from last year and expects the year to be equal to, or 5-10% lower than, 1959's record.

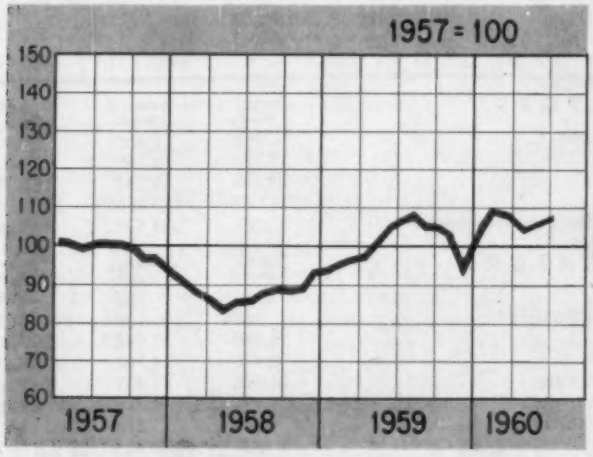
Manufacturers' sales of home appliances currently are lagging some 10% behind last year's level. High inventories reportedly are causing widespread discounting and price weakness. May inventories were the highest so far this year. Sales boomed during the first six months of 1959. Just the opposite is true in 1960, and the outlook is not clear at all.

Plastic molding shops reflect the appliance downturn. Most molders report business down 10-15%, lower backlogs, and expect 1960 to run about 15% below 1959 business levels.

Heat treaters are looking for a 10-20% gain in sales this year. Presently they are running about 80% of capacity after a good first quarter. The fourth quarter will make the difference between holding their own and hoped-for increases. Welding shops are concerned because the normal summer drop-off in ordering came a month to six weeks earlier than usual this year, and no one knows whether this is a trend that will carry through the fall or not.

The outlook for stampers depends on how closely they are tied to the automotive business. Auto supply stampers are running with output down to 40-50% of what it was in the first quarter. Non-automotive stampers are running about 15% ahead of 1959, but a slowdown is expected in the third quarter and backlog is nil.

Tool and die shops were hoping for a 15% increase in shipments in 1960. While the 25% spurt in the first quarter made the estimate look easy, the slump in the second quarter has had a sobering effect. Now, tool and die shops are hoping they will be able to reach their estimate. Something will have to come along to take the place of heavy automotive work if they are to hit that goal.



AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

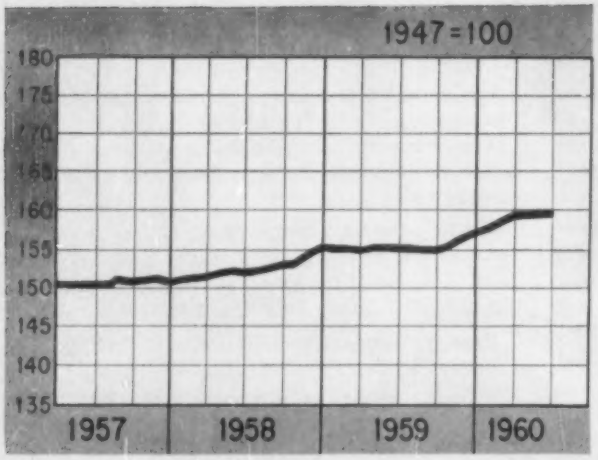
BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

108

	JUN. Estimated	MAY Preliminary	APR. Revised	JUN. Year Ago
Total Index	**108**	**107**	**106**	**107**
Machinery	103	102	101	
Electrical Machinery	115	114	107	
Autos	121	115	111	
Other Transportation .	92	89	97	
Other Metalworking .	109	106	109	

CIRCLE 235 READER SERVICE CARD

TRENDS WHAT'S AHEAD... in Business



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	JUNE Estimated	MAY Preliminary	APRIL Revised	JUNE Year Ago
Total Index	**159.9**	**159.7**	**159.8**	**159.2**
Metalworking Machinery	**191.2**	**190.4**		**184.9**
Other Machinery exc. Electrical	**173.1**	**173.0**		**169.6**
Electrical Machinery	**160.8**	**162.2**		**160.4**
Fabricated Metal Products	**147.8**	**147.9**		**148.8**

Credit easing should boost buying...

There are new reasons to believe that consumers will be able to step up their buying in the months ahead. For one, employment—including factory employment—has made substantial gains in recent weeks. Consumer incomes consequently are on the rise. So far this year consumers have indicated strong desires to make new purchases, and rising incomes will aid them in doing so.

On top of that, the Federal Reserve System has made definite moves to ease credit. As a result, consumers should find loans easier to obtain in the months ahead. Moreover, costs of borrowing should decline a bit. And lower credit charges will overcome resistance to installment buying in many cases.

Easier money is almost certain to give home-building an added boost in the months ahead. In so doing it will also boost demand for appliances and home furnishings generally.

In addition, there is new evidence to suggest that the pickup in machinery orders anticipated for the third quarter will materialize. That evidence comes from the latest quarterly survey of plant and equipment expenditures released this month by the Commerce Department. The survey confirms earlier indications that capital spending in the months ahead will be high and edging upward. Demand for producers' goods thus should remain strong.

Meanwhile, most key industries should be able to move through the summer months with output holding at high levels. This steady output pace is assured by backlogs of unfilled orders already on the books of major manufacturers.

In machinery, for example, the volume of unfilled orders is substantially greater than a year ago. And in non-durables unfilled orders have held at consistently-high levels in recent months. With the notable exception of primary metals, most manufacturers have been receiving orders at a pretty good clip in recent months. The pickup in orders expected for the fall thus could mean substantial gains in output.

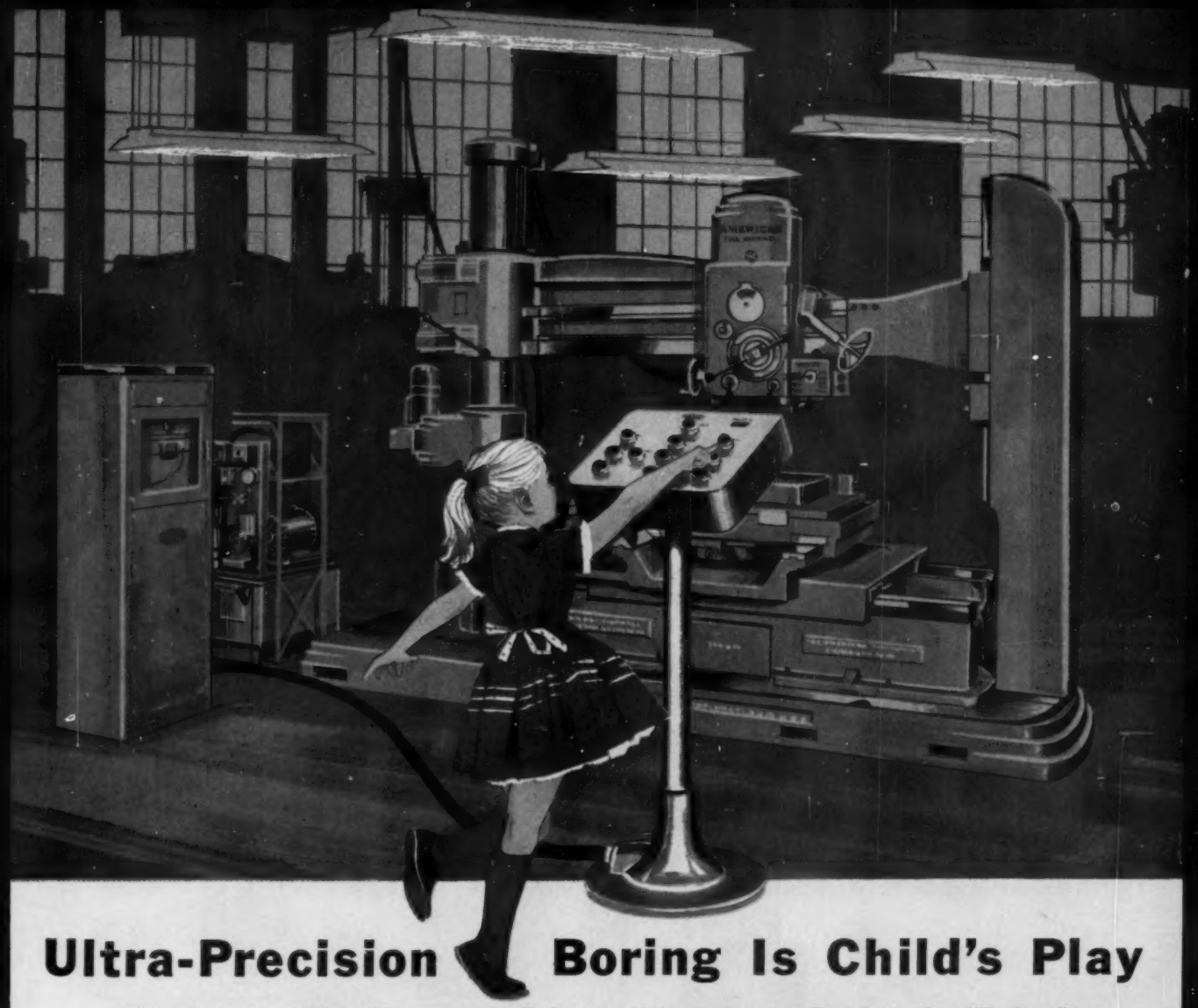
WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949=100)*	150.9	150.0	157.6
Steel ingot operation (thousands of tons)	1,775	1,756	2,620
Electric power output (million Kilowatt hours)	13,766	13,134	13,503
Production of automobiles and trucks	141,838	115,068	127,029
Engineering construction awards (Eng. News-Record—thousands)	91,407	87,703	89,752

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production (1957=100)*	110	109	109
Index of durable manufactures production (1957=100)*	108	106	109
Durable goods manufacturers' sales, millions*	15,098	15,166	15,166
Machinery manufacturers' sales, millions*	4,873	4,748	4,423
Durable goods manufacturers' new orders, millions	14,442	14,637	15,796
Machinery manufacturers' new orders, millions	4,704	4,735	4,632
New Orders for Nonelectrical Machinery (1950=100)*	173	173	187
New Contracts for Industrial Construction (1950=100)	139	132	127

*Seasonally adjusted



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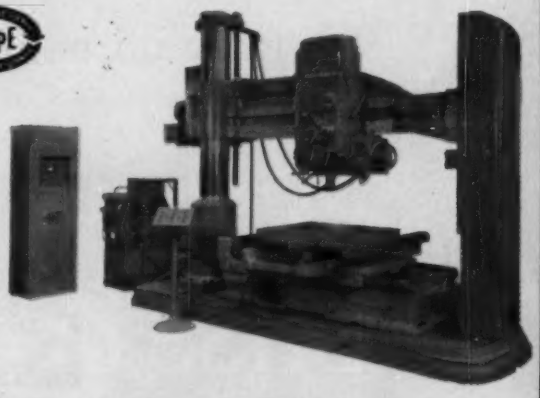

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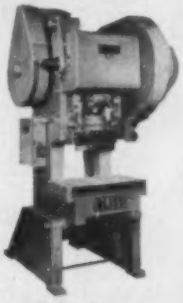
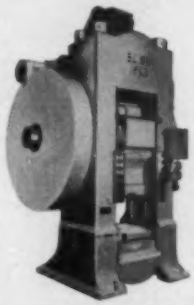
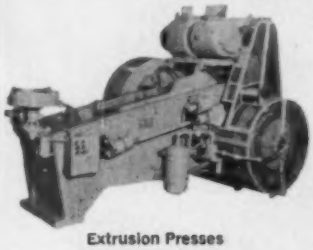


Inclinable Presses
single crank and double crank

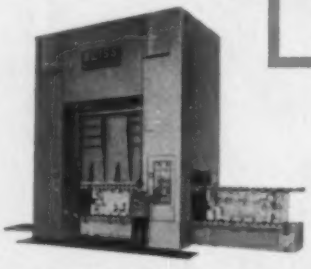


Knuckle Joint Presses

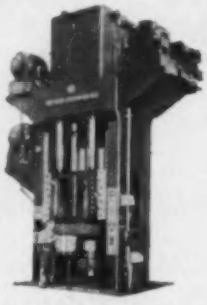


Extrusion Presses

Eccentric Presses



Rolling Bolster Presses



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The Precedent-Shattering 1960s

Predictions about the growth of the American economy the next ten years have become a popular pastime. No matter how spectacular that growth may be, however, it is likely to be dwarfed by the far-reaching developments in metals and manufacturing techniques.

Nowhere else will these developments be so precedent-breaking as in the aircraft and space-vehicle industries. For the urge for better defense weapons and for exploration of space is overwhelming. What's more, Congress is almost sure to make available the funds to see the programs through.

The Aerospace Industries Association has spelled out what we can look for. It strongly stresses that the time cycle from the beginning of design to production of advanced weapons will become shorter in the coming decade. Increasingly complex tools, methods and equipment thus must be designed, produced and installed in a briefer time than ever before if the production phase is to start without serious delay.

New materials will create . . .

critical problems. Some of the materials will be hard to form. Others will require new chemical or electrical discharge machining methods. Many will lend themselves to fabrication only at high temperatures and will need protective coatings and/or atmospheric control to prevent contamination.

The search for and use of new materials will point up the necessity for new production facilities, the association believes. Only by utilizing better and more expensive equipment will the new and more complex processes be fully exploited.

Automation and numerical control will have to be applied on a wide scale. Present handling and testing equipment will have to be designed and built to greater sensitivity. And new standards of quality control and of data evaluation will come into being.

As high-strength steels and titanium alloys gain acceptance, products will have to be shaped as closely as possible to their final forms. Materials will be formed hot or cold with greater accuracy on semi-automated equipment with precise controls. Certain metals, plus almost all ceramics and cermets, will need to be worked with ceramic tools, abrasive grinding, ultrasonic machining or electrical discharge machining.

The association suggests areas . . .

in which much developmental work should be done. Grinding for high metal-removal rates is one. Cutoff saws of synthetic industrial diamonds is another. Subzero machining or other techniques using improved cutting lubricants and coolants is a third.

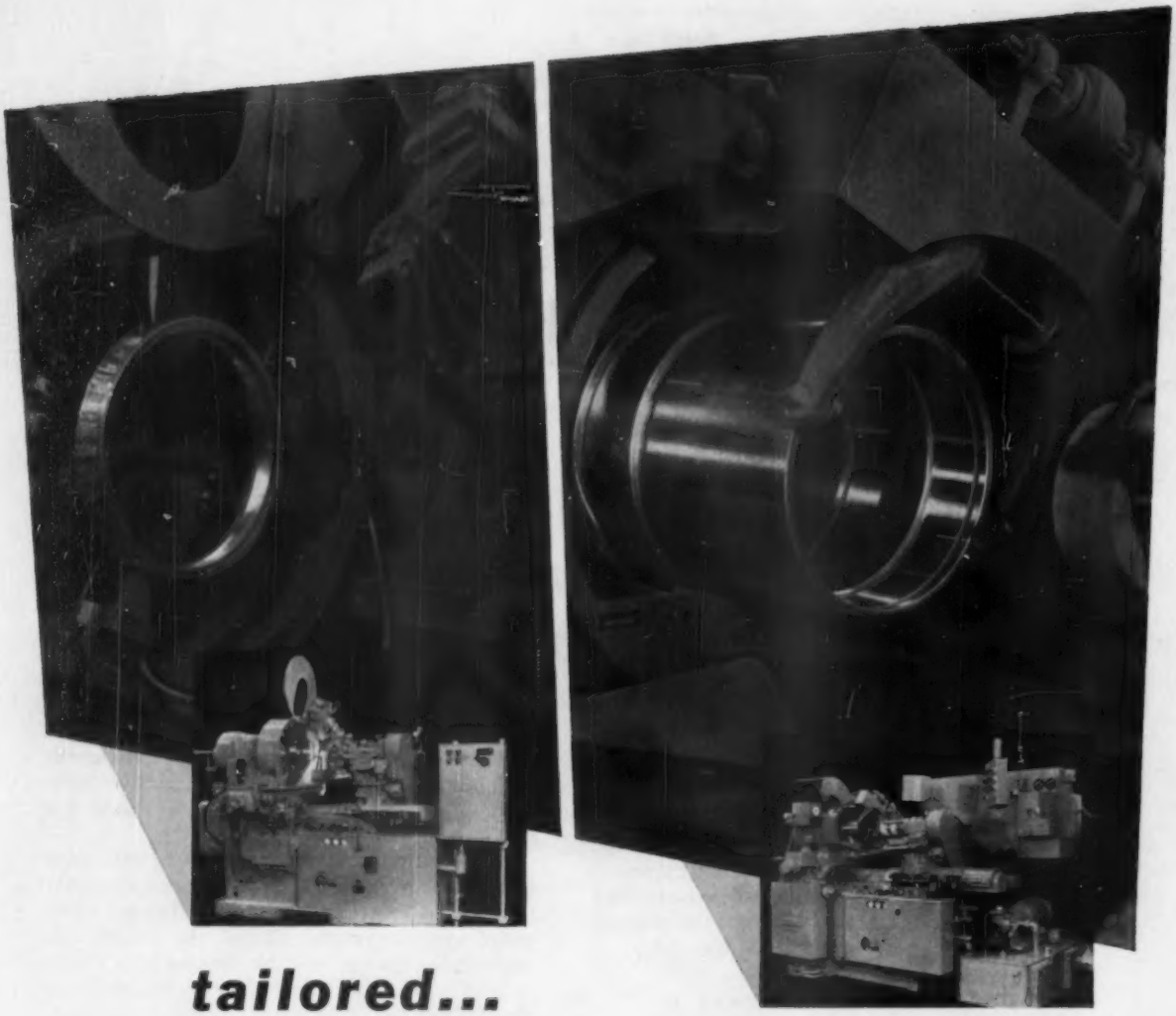
Solid and important developments will occur in virtually every kind of metalworking process. Plating, coating and cladding, aided by automatic control systems, should see notable advances. Equipment will be designed to anneal or heat treat large components at temperatures above 2000 deg F in closely-controlled atmospheres.

This recital of what the 1960s hold for Metalworking could go on and on. Technological advances will be fastest and most furious in the areas where pressure of national security bears down hardest. But they also will be seen in numerous other segments of Metalworking, where the pressure of competition is as persuasive as national security in speeding new developments.

With this challenging prospect . . .

confronting him, every metalworking manufacturer must consider what these developments portend for him. He cannot afford to forget them for a minute. If he expects to prosper in the 1960-1970 era, he must be an active participant in them. Any other course will lead to erosion if not destruction of his business.

Burnham Finney EDITOR



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THIS METALWORKING WORLD

The face of world industry is changing. Expanding trade abroad and rising standards of living at home have created an era of unprecedented prosperity among leading metalworking nations. What lies behind this economic and industrial renaissance? Can it last? Here is the first in a series of on-the-scene reports from the world's metalworking capitals

Britain — Land of insecure prosperity

By Nicholas Landon and John Shinn, AM/MM London Editors

Like a child who has been given a sugarcoated pill, Britain today is enjoying the sweet taste of prosperity, but is wondering how long it will last.

The sugar coating: increasing exports, expanding industrial plant and production, a fast rising standard of living.

The bitter pill underneath: a declining share of world trade (despite rising exports), overextension of installment buying, too-free bank credit for industrial expansion, fear of what the European Common Market will do to British trade in continental Europe.

Britain's economists and government are running just a little scared of two things—a boom that could go bust, and strong foreign competition for traditional British markets. Inflation, too, is a very real fear in Britain today. Both the people and industry are borrowing to the limit to keep up with, respectively, the Joneses next door, and the Volkswagens of Germany.

Britain's merry-go-round of prosperity could become a vicious inflationary circle if something isn't done to slow it down.

The circle begins with the people: More than 98% of the workforce is employed, and a steady job means credit for buying homes, automobiles and appliances—all on the "hire-purchase" plan.

For the first time, Britons are as prone as Americans to go into debt to raise their standard of living. The country's installment plan debt more than tripled between December 1955 and December 1959—and too much installment buying is an invitation to inflation.

Auto backlogs pile up

As a result of the consumer spending spree, makers of consumer hard goods—particularly automobiles and appliances—are flooded with orders. Ford of England's Anglia, for instance, is reportedly lagging a year behind on deliveries, occasioning a somewhat startling comment from Board Chairman Sir Patrick Hennessy. "This company's inability to keep up with current demand," he said recently, "is shocking."

Ergo, if you can't keep up with orders, you have to expand. So off to the bank to borrow more money to build a new plant that will employ more workers who will buy more cars and appliances, and so on ad infinitum.

All very well if it were all done with cash. Instead, it's being done with long-term credits. How can a bank turn down a man with a steady job, or a company with overflowing order books?

Yet the British government, feeling that something must be done to halt the credit spree, has repeatedly warned the banks to go slow. The warnings have largely been ignored. Now, the government is preparing to hike the bank rate, and to slap new restrictions on bank loans and installment buying.

Meanwhile, British metalworking, buoyed up by consumer spending and seemingly unlimited expansion money, is riding the crest of the boom. Industrial output has been increasing something like 4% a year—outpacing the country's gross national product, which has jumped from an annual $46 billion to $56 billion in the last five years, in spite of a mild recession in 1958.

Sailing high, wide and handsome through the '58 recession was the automotive industry, which has

Britain . . .

doubled its output since 1950, and expects to double it again by 1963.

To achieve this production goal, the industry has already spent $420 million for expansion, and the "Big Five" alone (Ford, GM-owned Vauxhall, British Motor Corp, Standard-Triumph, and Rootes) are planning to spend another $475 million.

As they grow, Big Five companies tend to become more and more self-sufficient. Ford, Standard, BMC and Rootes have all bought their own body companies, leaving only one big independent, Pressed Steel Co, in the field. Foundry work has largely been pulled back into Big Five shops. In the largest remaining "outside industry," electrical equipment, the Lucas group holds a virtual monopoly, with only a very small challenge from Wico-Pacy.

Domestics sales zoom

Back of all this prosperity and expansion is the tremendous growth in domestic car sales. Today, there are nearly 5-million cars on British roads—largest number per square mile anywhere in the world. Ten years ago, there were less than half that many.

In spite of this upsurge in British car ownership, there is still only one car for every 10 Britons, leaving a huge potential of new automobile owners.

This largely untapped domestic market will be around for a long time, because Britain exports a phenomenal percentage of its automotive production—something like 60%. The traditional Commonwealth market is still the biggest outlet for British vehicles, but its importance has been diminishing steadily since World War II.

The United States is today the biggest single-country market for British cars by a wide margin. More than 208,000 vehicles were sold here last year alone. Cumulative price tag: $143 million.

But now, with the advent of the U S compacts, British automakers fear that the bloom is off the American boom, unless an almost untouched potential market for trucks can be tapped.

Continental Europe, which up to now hasn't been a major market for British vehicles, is getting a lot of consideration. Oddly enough, the greatest potential lies within the six countries of the European Common Market—where sales rose more than 30% last year—barring a split between the "Inner Six" and the British-led "Outer Seven."

The British have few illusions on this score, believing that the rift between the two trade groups is widening if anything. For this reason, British automakers are busily setting up plants within the confines of the Common Market area. Standard-Triumph, for instance, already has a plant in France, and has bought another at Malines, Belgium. BMC last year signed on Italy's Innocenti to make Morris and Austin cars, while Rootes is negotiating to build or buy a plant somewhere within the Six. British Ford and Vauxhall, on the other hand, are leaving the area to their U S parents' subsidiaries in Germany.

Britain's automotive manufacturers view their country's participation in the European Free Trade Association with mixed feelings. As internal tariffs come down within the seven EFTA nations, the British will gain little, because those countries already have low tariffs. On the other hand, they are committed to a group that does not include top European markets for British cars. Not only that, the British stand to lose their own tariff protection against Sweden's Volvo and Saab cars.

Electrical manufacturing

Output of the British electrical manufacturing industries has almost doubled since 1950, last year added up to $3.9 billion. All branches of the industry, from heavy equipment to electronics components, have shared in the fast growth. One of the biggest jumps in output has been racked up by the appliance industry.

Here again, as with automobiles, the average Briton's whirlwind love affair with "buy now, pay later" has been responsible for the industry's prosperity. Aided by a lifting of installment buying and other credit restrictions in 1958, appliance sales by last year's end had climbed to around $500 million from 1958 total sales of $390 million.

Adding to the boom in appliances is the huge postwar expansion of the country's nationalized electric light and power industry; generating capacity has more than doubled since the end of World War II. Because of this and the availability of installment buying, the percentage of British householders owning refrigerators increased threefold in the years 1948 to 1958.

On top of the burgeoning domestic appliance market, British manufacturers do a big business (20 to 25% of total output) in Commonwealth and other overseas markets. About one-sixth of the $3.6 billion in electrical exports over the 1954-1958 period were sold in continental Europe.

As a result of growth in foreign and domestic demand for electrical equipment of all kinds, from power-generating equipment to small appliances, the big, established companies are going in for huge expansion. At the same time, small companies are springing up like mushrooms all over the country.

The electrical giants

Britain's three biggest electrical manufacturing firms, all of which produce everything from heavy generating equipment to small appliances, have chalked up a phenomenal growth in assets in the last decade. General Electric Co had assets of $103 million in 1950, today is worth $229 million, and its rate of growth has been far smaller than that of Associated Electrical Industries (1950 assets $77.2 million, 1960 assets $463.2 million) and English Electric (1950 assets $47.2 million, 1960 assets $230 million).

Fast-growing Associated Electrical Industries in the last three years alone has spent $70 million on an expansion program that has included plants to double output of washers and refrigerators.

Success story . . .

Even more spectacular than growth of Britain's electrical giants has been that of such firms as Morphy-Richards Ltd. Started just before the war as a maker of electric irons and small heaters, the company chalked up only $28,000 sales its first year. Then, its plant was 4000 sq ft. By last year, annual sales had reached slightly over $25 million, and the plant had grown to 460,000 sq ft. A new plant in Scotland will add another 340,000 sq ft to the company's appliance manufacturing facilities this year.

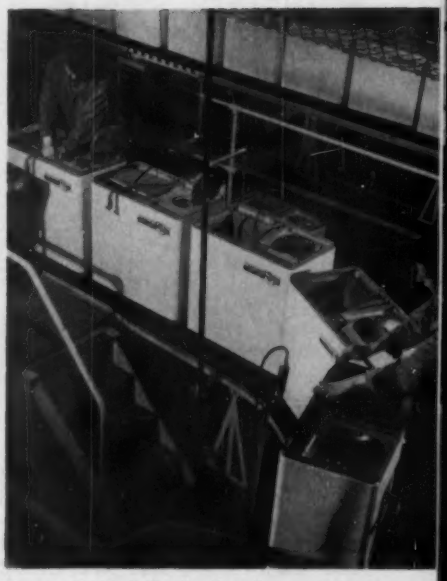
. . . and another one

Or look at another "small" electrical manufacturer, which began as a defense contractor in 1942, then after the war went into refrigerator manufacture—a field then dominated by U S brands. In 1946, totals assets of LEC Refrigeration Ltd were $22,400: Last year they were $12.6 million. The company now makes 1200 refrigerators a day.

American influence on the United Kingdom's electrical manufacturing industry is diminishing steadily. The

American subsidiaries are playing a major role in Britain's metalworking boom

This is General Motors' giant Vauxhall complex at Luton, where automobiles, light trucks and cabs for heavy trucks are made. Automobile production building (at far end) alone has 1,125,000 square feet of floor space



Hoover Ltd of England makes washing machines, other appliances, and electric motors, as well as vacuum cleaners

companies that now form Associated Electrical Industries were once mostly subsidiaries of such U S firms as General Electric and Westinghouse. But AEI today is strictly British, ever since GE sold out in 1953. Today, most AEI appliances bear the Hotpoint name, but have no relationship to U S Hotpoint.

Two American companies still have a strong grip on the British appliance industry, however: Hoover and Frigidaire.

Hoover, in fact, has been established in the United Kingdom so long and so well that to this day Britons speak of "Hoovering" a rug, rather than vacuuming it. Not only is Hoover Britain's largest vacuum cleaner manufacturer, it is growing bigger. Sales jumped 50% last year, and the company is starting an expanson scheme which will add 375,000 sq ft to its existing 1.4- million-sq-ft plant space.

Frigidaire, which has been established in Britain since the 1920's, moved into that country's refrigerator market after World War II with astounding success. It is currently carrying out a major expansion and modernization program at its 583,000 sq ft plant in North London.

Electronics boom

But by far the most spectacular growth among Britain's industries has been that of electronics.

Output has increased six-fold in the last decade, last year amounted to something like $1.4 billion in sales. And the boom is by no means over—the industry is expanding at a rate of somewhere between 10% and 20% a year.

About one-fourth of total industry sales has been in components, which added up to $336 million in 1959—up 20% in one year. Mainstay of the electronics boom has been the jump in radio and television set sales. Nearly 3 million television sets were sold in Britain in 1959, 800,000 more than in 1958. Also on a steeply rising sales curve are automation equipment, closed circuit TV and defense and industrial electronics.

High export ratio

A much higher percentage of British electronic production goes for export than in the United States. Electronic exports take around 20% of total British production — about $308 million last year alone. (The United States electronic industry's exports amount to about $420 million a year, or roughly 4% of total output.)

Biggest share of exports goes to the British Commonwealth, but continental European and U S markets are coming up fast. Last year, the United States was the biggest buyer of British-made hi-fi equipment—$14 million worth.

Because of the boom in domestic and foreign markets, the "big boys" of prewar British electronics have grown into giants. At the same time, somewhere between 30 and 75 new firms spring up every year—some to fail, some to survive on their own, others to be bought up by bigger outfits. It is now estimated that there are nearly 2000 companies in the field.

Electronic mushroom

Typical success story is that of Solartron Electronic Group Ltd, which started in a small way in 1948 as a maker of electronic controls for missiles. By July 1959, it was well established in the industrial processing control field, was chalking up annual sales of nearly $6 million. Solartron expects to better that total by a third this year. One reason: licensing agreements with such U S companies as Rheem Mfg Co, Con-

solidated Electrodynamics, and Industrial Electronics. And to get new capital for a heavy R & D program, Solartron has sold a controlling interest to Firth Cleveland, but it keeps its operating independence.

Such licensing agreements as Solartron has with U S companies are legion. The traffic, pretty much one way (U S as licensor) at the start, is now flowing in both directions. There is also an increase in U S companies setting up manufacturing subsidiaries in the U K. Some examples: Philco, RCA, Texas Instruments, Sperry Gyroscope, Foxboro-Yoxall, IBM, Hogan Controls, Square D, and Dynamics Corp of America.

Aircraft and missiles

Britain's aircraft industry has made headlines with its ups and downs, and with its off-again-on-again mergers, groupings, and consolidations. Main trouble is that at Korea's outbreak Britain went all out to boost aircraft and missile production, tripling output between 1951 and 1957. Then, like the United States, the government pulled the rug out from under the industry by severely curtailing military buying. To top it all off, Britain at the same time began to lose ground in the commercial aircraft field. End result: too many companies with too many competing designs chasing too few orders.

The industry is now attempting to digest a massive reorganization, forced down its collective throat by onetime Defense Minister Duncan Sandys, who now heads the new Ministry of Aviation.

Essentially, the British aircraft industry now consists of two major airframe groups (1: Vickers-Armstrong, English Electric and Bristol. 2: Hawker-Siddeley and De Havilland), two engine groups—one headed by Rolls Royce, the other by Bristol-Siddeley Engines Ltd—and a helicopter group under the wing of Westland Aircraft.

The main idea: to weed out the winners from the welter of aircraft designs, and to get rid of the losers. (Britain at the moment has 28 military and 17 civil airplanes on the boards or at least in some stage of production.)

How well the new setup will work depends to a great degree on government financial backing, which has been promised but no concrete commitments made.

Seemingly, the new Ministry of Aviation is off to a flying start in the wrong direction (at least in the minds of aircraft and missile people) with cancellation this April of the De Havilland Blue Streak, an Atlas-type missile, after expenditure of about $280 million on the project. Not only was this a shock to the industry, but a blow to its technical prestige.

Even so, there is considerable confidence that the industry can weather the storm of drastic reorganization, and achieve its goal of cornering one-fifth of the world's aircraft business.

Lean days ahead

Any way you look at it, however, Britain's aircraft industry has a lot of belt tightening to do before it can hope to grab a big piece of the world aircraft pie. It is now estimated that industry employment, which hit 240,000 in mid-1959, will be down to 10-years-ago levels of 162,000 by 1963.

The lean days ahead are causing major aircraft firms to diversify into other fields. Britain's biggest, Hawker-Siddeley, in just a few years has switched from being 85% aviation to 75% non-aviation. It now has interests in steel, shipbuilding, electrical power plants, marine and diesel powerplants, coal mining, bridge building, and even nuclear energy.

Materials handling equipment

Mechanical handling has been a growing field in the postwar years, but its growth has been slower than expected in the last few years. As a result, the field is overcrowded.

For example, one industry spokesman puts it this way, "Five years ago the orders tumbled in. Now we have to go and fight for them." Take, for instance, fork trucks—introduced to Britain by U S forces during World War II. Sales climbed rapidly until 1955, when they reached $20 million. Yet last year saw sales of only $22.5 million.

Competing for this amount are America's Hyster, Yale & Towne, and Clark, all of which have manufacturing interests in the U K. Top British competitors are Lancing Bagnall and Coventry Climax Engines.

Overall, the materials handling industry last year chalked up $241 million in sales, of which 28% or so was for export.

Textile machinery

Reflecting the long decline of textile manufacturing in Britain, textile machinery sales have been gradually falling off. Example: 1955 sales amounted to $179.5 million, 1957 sales were $176 million. But last year the government stepped in with an $84 million scheme for equipment replacement in a reorganized and contracted textile industry. Since then, sales have stepped up to $203 million, but the upsurge will be short lived—under the plan, all orders must be placed by 1962's end, and all deliveries made by 1964's end.

Shipbuilding

Another exception to the general rise in metalworking production is shipbuilding, which at best has coasted along in neutral gear for the last 10 years. Annual launchings have averaged around 1.3-million gross tons, not enough to keep pace with the fast rise of Japan and West Germany. As a result, Britain has dropped from first place to third among the world's shipbuilding nations. In the postwar years, Britain's share of total world launchings has plummeted from 53% to 16%.

Actually, shipbuilders of all nations have suffered from a general shipping slump in the last two years. Even though Britain's backlog has fallen off by 2.8-million tons since 1957, it has the largest backlog of any shipbuilding country (4.2-million tons aganst 3-million tons each for Germany and Japan). Trouble is, much of this backlog is caused by Britain's slow output.

Looking ahead, the big yards will have to modernize so as to step up production and get prices down if they are to compete with Japan and Germany, which today have a definite competitive edge in price and speed of delivery. And unless world shipping comes out of its slump soon, it looks as though many of Britain's smaller yards will fail in a year or two.

U S companies in the UK

American metalworking companies have invested heavily in Britain ever since Singer Sewing Machine opened a plant in 1867.

Today, more than ever, American firms are setting up subsidiary shops in the United Kingdom, most of them with an intention of getting a foot in the European Free Trade Association door.

U S direct investment in Britain has more than tripled since the war, with most of the increase coming since 1950. It is now estimated that Americans have poured $1.6 billion into the country, $1 billion in manufacturing.

The list of U S companies in Britain takes in a high proportion

of blue chip companies. To take just one field, office machinery, the roster includes Sperry Rand, Underwood, Addressograph, Dictaphone, and National Cash Register.

Not only is Britain's domestic market an attraction, but a U K base readily serves countries of the British Commonwealth and those of continental Europe. That is why American-controlled firms in Britain export 40% to 50% of their total output, are responsible for about 14% of total United Kingdom exports.

Products are not yet exported back to the United States in any quantity, but there is a growing trend in this direction, as is evidenced by Ford and Vauxhall. Sperry Rand (or Remington Rand as it's still called in Britain) exports about 78% of the entire output of its typewriter plant in Scotland, much of it to the United States. This is also true of newly-arrived-in-Britain Cummins Engine Co, which ships excess output of finished castings and forgings (pistons, crankshafts, and bearings) from its new $2-million Scottish plant back to the states. Particularly noteworthy is a new U S trade gambit. Not to be caught with their production down when and if the expected split between the Common Market and Outer Seven countries comes, American manufacturers are setting up one plant in Britain and another in the Common Market.

Labor and automation

Recently, an English industrialist said, "U S industry's efficiency has been forced upon it by high wages."

This is not true of Britain, where automation is slow in getting a foothold because wages are still very low by U S standards. For instance: average earnings last year of a skilled British lathe operator amounted to less than $42 for a 44-hour week.

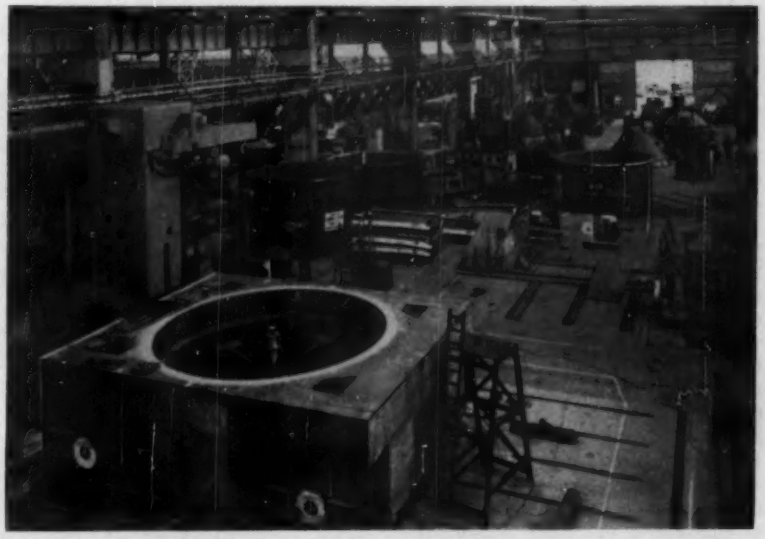
But this same skilled worker made only $26.50 for a 44-hour workweek just four years ago. Wages, in other words, are climbing steadily, and will continue to do so. Manufacturing wage rates generally rose 5.5% in 1957, 3.5% in 1958, and nearly 4% in 1959.

In the last few months, the standard metalworking workweek has been cut from 44 to 42 hours, and this summer the trade unions are expected to plump for a general wage hike of $2.80 a week. In the years ahead, both management and government are hoping to hold increases to 3% a year, but two factors make this extremely unlikely.

Booming: electronics manufacture

Assembling electron guns at Mullard Ltd, one of Britain's largest manufacturers of electronic equipment of all kinds

Recovering from lean years: heavy machinery manufacture



Heavy machine bay at Ashmore, Benson & Pease's South Works, where equipment for steel production and the chemical and petrochemical industries is made

First, there just aren't enough workers to go around. Only 1.8% of the employable population is out of work across the nation. This means that in highly industrialized areas workers are at a premium—a strong bargaining point for any union. The tightness of the employment situation is even more apparent when national unemployment figures are analyzed and it is found that most of the jobless are concentrated in depressed areas with such sagging industries as textiles and coal mining.

Even so, the British industrialist is not as plagued by strikes as his American counterpart, mainly because bargaining is done on an industry-wide basis and union leaders are inclined to stick to their agree-

ments. Such strikes as do come off are wildcat ones, usually triggered by militant (and often Communist) shop stewards who ignore their union official.

Last year was considered a record year for strikes in Britain. Something like 5.3 million workdays were lost in stoppages of all kinds. Sounds impressive until you figure this into the total manhours worked; the result is less than 4½ hours per year per worker.

Britain and world markets

Great Britain is in the peculiar position of watching its exports grow, while it loses its share of world trade. West Germany, for example, has overtaken Britain in several fields—automobiles and shipbuilding are just two.

Britain, for reasons considered unaccountable by many of her people, at first shied away from joining the European Common Market. Later, the six member nations as much as told Britain she wasn't wanted or needed. Consequently, the United Kingdom now finds itself economically allied with the much less powerful European Free Trade Association (the Outer Seven).

Common market woes

The British government is frankly worried over what will happen to its European markets if the Common Market nations (Germany, France, Italy, and the Benelux countries) decide to eliminate tariffs among themselves and at the same time establish a common barrier against the rest of the world.

Lowering of trade barriers on the most lucrative segment of Britain's continental European market would most certainly act as a checkrein on British industrial expansion. If an economic rift does come between the Common Market and the EFTA nations, the United Kingdom would then be forced to concentrate upon her own Commonwealth markets on the highly lucrative U S market, and on developing business in the underdeveloped countries. She will gain little advantage in trading with the already-low-tariff nations of the Outer Seven.

Even though Britain is faced with stiffening competition for world markets, and by possible inflation at home, her government seems to have picked up some of the optimism that pervades industry.

Outlook: bounding optimism

Recently, the British government renounced the right to impose import restrictions ordinarily denied most member nations of the General Agreement on Tariffs and Trade. For 12 years, Britain had had the right to restrict some imports because of her balance-of-payment difficulties. By renouncing that right, Britain is entering without fear or favor into what it believes will be "a new and unprecedentedly prosperous era in international trade."

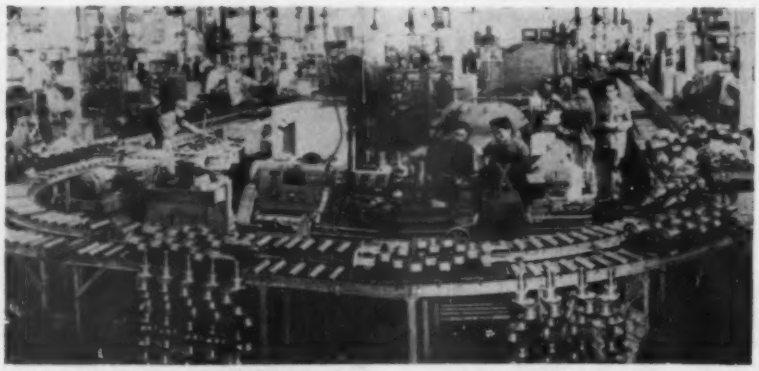
Red Chinese tractor works exceeds designed capacity

The New China News Agency recently reported that the Loyang No. 1 Tractor Works, completed late last year, has reached and is now outstripping its designed capacity of 15,000 tractors a year. At present, the plant is turning out 54-hp diesel crawler-type tractors at the rate of one every eight minutes.

Located on a 370-acre site in central China, the plant was built by 38 Soviet specialists who are now engaged in training more than 150 Chinese technicians. Nearly 10,000 workers are employed in the manufacture not only of the 54-hp tractors, but also of smaller tractors, machine tools, electric motors, engines and pumps, and large quantities of tractor accessories.

The Chinese Communists claim that the plant has over 10,000 sets of up-to-date machines and instruments, mostly Soviet supplied, but they fail to say what kind of machines they have.

Despite the earlier Soviet assistance, the Chinese are aiming at self-sufficiency. One report has it that a group of young punchpress operators in a 3-hr stint turned out 136% of the quota for their entire 8-hr night shift by introducing five technical innovations. But again, the ingenious Chinese failed to say just what the innovations were.



Tractor engines are assembled on a roller-conveyor assembly line. About 10,000 workers are engaged in production of eight types of tractors

"Tungfanghung" (The East Shines Red) 54-hp diesel crawler tractors roll off the assembly line at a rate of one every eight minutes, according to Red Chinese reports

Molten-metal delivery, low-pressure molding, low-distortion assembly...

Special techniques produce aluminum Corvair engine

Distortion is the big problem to avoid when you're building aluminum engines, and it lies behind many of the special setups and unusual techniques at Chevrolet's Tonawanda engine plant, where air-cooled pancake Corvair engines are being assembled.

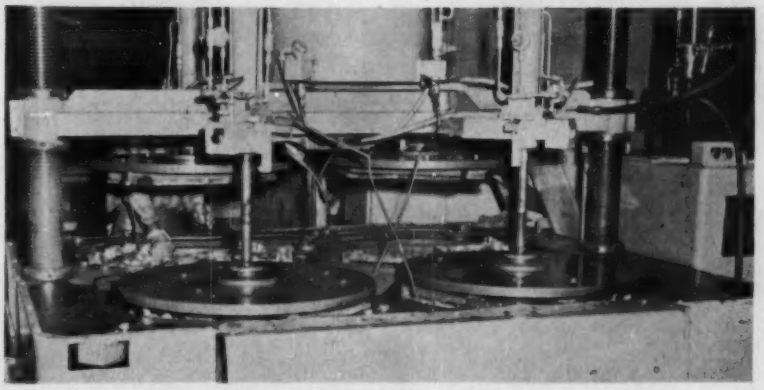
One special setup aimed at reducing distortion is a production lapping machine that resurfaces mating faces of crankcase halves after they have milled to ±0.002 in., making the surfaces flat and parallel within ±0.001 in. This prevents distortion when through bolts are assembled with multiple nut runners, then tightened with torque wrenches. Accurate matching is especially important here, because the assembly is made twice; once to join the crankcase for crankshaft-bearing-hole boring, and again to include the crankshaft during final assembly.

Distortion is also avoided at the end of the assembly line where a new multiple nut runner (Gardner Denver) assembles the bottom crankcase pan by driving 19 automatically fed nuts at the same time.

Machining aluminum is different from machining cast iron at several stations. Although a considerable amount of transfer-machine work such as drilling, reaming, boring, and milling is much like the same operations on cast iron, the crankcase halves must be milled on their sides and mating surfaces, not broached as they are usually handled, to gain the higher surface cutting speed and heavy feed necessary special tooling for good cutting action in aluminum.

Deburring is a more serious problem with aluminum than with cast iron, but this is handled on a number of aluminum parts by transfer machine, where rotary brushes clean up the machined edges of the parts. Wire, fiber, and even nylon brushes have been applied.

Because the pancake engine is much lighter than the inline 6 formerly produced at the Tonawanda plant, as well as the two V-8's still being assembled in the same plant, a special assembly-line fixture was possible. Instead of supporting the engine on a dual-trunnion fixture, which allows limited rotation, a single-arm fixture with 360° rotation in any plane is possible. This unit is built with standard production Chevrolet front-end steering knuckles and bearings. Final assembly along this line involves some 300 air-powered tools and 15 multiple nut runners. The 600-ft line has 316 fixtures set on 4-ft centers.



Production lapping machine surfaces mating crankcase halves within ±0.001 in. to reduce distortion when through-bolts tighten up the crankcase. Crane Lapmaster does a dozen blocks in around a minute. Parts are manually unloaded to conveyor

Casting and molding

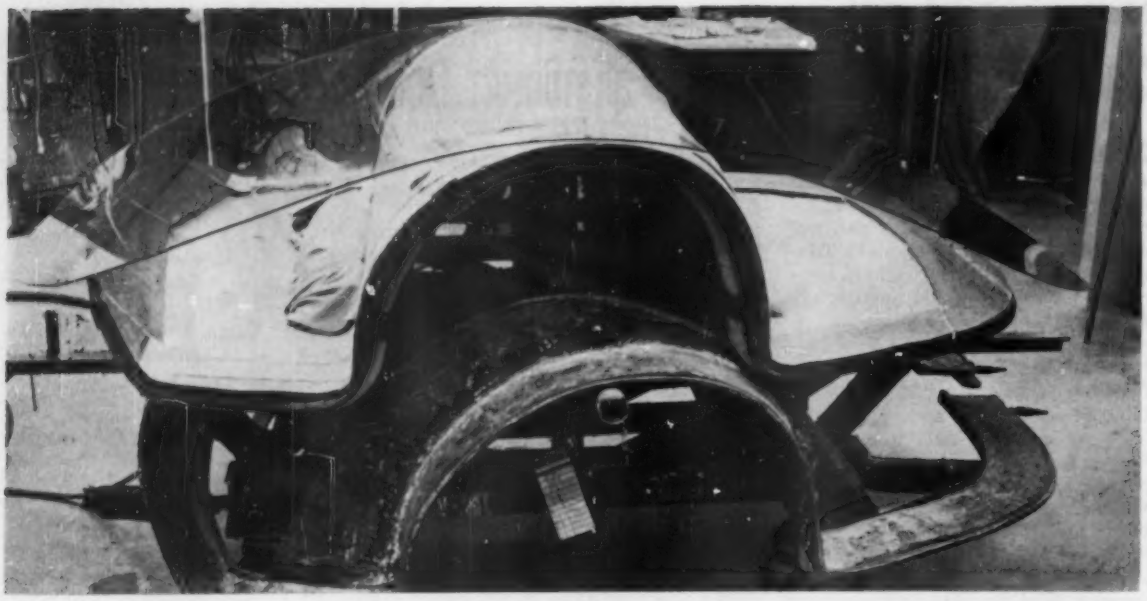
All aluminum parts for the Corvair engine — which includes two halves of the crankcase, cylinder heads, inlet manifolds, rear housing, oil-filter and generator adapter, and camshaft gear—are produced some 300 miles away by truck or train at Massena, N. Y. Here a three-company complex focuses on aluminum. A Chevrolet foundry casts parts for the engine—all in aluminum. The raw material is provided by a three-year-old Reynolds Metals reducing plant. Power for aluminum reduction is provided by the New York State St. Lawrence Seaway power project.

All three units, of course, are not working exclusively on each others' products. The power project, taking half the power output from the seaway project (the other half goes to Canada), distributes to a number of large industrial customers (such as Chevrolet and Reynolds), to private utilities (Niagara Mohawk is one), and to local towns such as Plattsburgh, N. Y.

Reynolds, taking about a quarter of the available US seaway power for aluminum reduction, in turn produces pig aluminum for many customers, as well as continuous horizontally cast bars (square, round, some as large in diameter as 6 in.). About a third of the aluminum output goes to the Chevrolet foundry as molten metal; taken directly from the reduction pots in a ladle, alloyed as necessary, then moved on trucks less than a mile to the foundry. Heat loss during the transfer is less than 100 F, and the saving to Chevrolet amounts to 10% in material costs.

At the Chevrolet foundry, most of the large parts for the Corvair engine are produced by low-pressure molding, a process known in Europe, but new in this country. In this equipment, the mold cavity is above a holding pot, and molten aluminum is forced into the mold by 10-psi air. It is a closed process and produces clean castings. There is little metal turbulence, compared to die casting, and castings have high density. Gates and risers are small because the metal is moved slowly, and there is little scrap loss. Productivity is improved over European practice with automatic mold actuation and timing. Complete air and electric safety interlocks are included. The equipment is less costly than that for die casting—about the same as for permanent-mold casting.

Several parts, including pistons, are die cast for the Corvair engine at Massena. The engine assembly also includes steel—forged cranks, crankshafts, and crank cap ends—and cast iron—exhaust manifolds. After final assembly, the engines are crated in three's, then shipped to automobile assembly plants.



Trimmed to templet size, Plexiglas sheet is preheated to 325 F, then is laid on this Bell-designed fixture to go into oven for further heating

Blowing bubbles is serious business

Blowing giant Plexiglas bubbles is a fascinating thing to watch, but to the two-man team doing the job, it is an art that can be exacting to the point of frustration.

100 bubbles a month

Bell Helicopter, Globe, Texas, has to produce 100 of them a month for helicopter canopies—not just huge transparent versions of what a kid blows with bubble gum (although the basic principle is remarkably similar), but bubbles that must meet ultra-strict military optics control specifications. These military tolerances are absolute 100%, except for some leeway in headroom and pedestal areas.

Fiber glass fixture

The bubbles are blown from 3/16-in.-thick Type II Rome & Haas Plexiglas on a fiber glass tool fixture designed and built by Bell. With this arrangement, Bell has succeeded in getting bubble-blowing time down from seven hours to just 50 minutes in the last five years.

Here is how it's done:

A sheet of Plexiglas, masked for protection during shipment, is trimmed to templet size. Masking is then stripped off and the sheet is cleaned and polished with surgical cotton and special polish to guard against nicks and scratches.

The sheet is inspected for surface defects, and if it is okay, is preheated to 325 F before being laid on the fixture—just enough heat to make the sheet flexible, so that the glowing collar and clamp rings can be installed. Then a 1½-inch hose under the frame closes the blowing ring and seals the sheet to a rubber surface, so that it will hold compressed air.

Partial blowing first

The sheet is returned to the oven, brought up to 325 F again, and held there for seven minutes. At this time, the bubble is partially blown, to keep wrinkles from developing in tight areas around the seals. Air pressure is 2 psi.

Sheet is removed from the oven, and the bubble is blown to its full size. It is then allowed to cool, with air pressure kept constant in its interior to prevent collapse. After cooling, the bubble is trimmed and inspected for optics. The whole cooling process takes about 25 minutes.

For optics inspection, the bubble is placed on a wooden frame which simulates a helicopter cockpit. Inspection is manual.

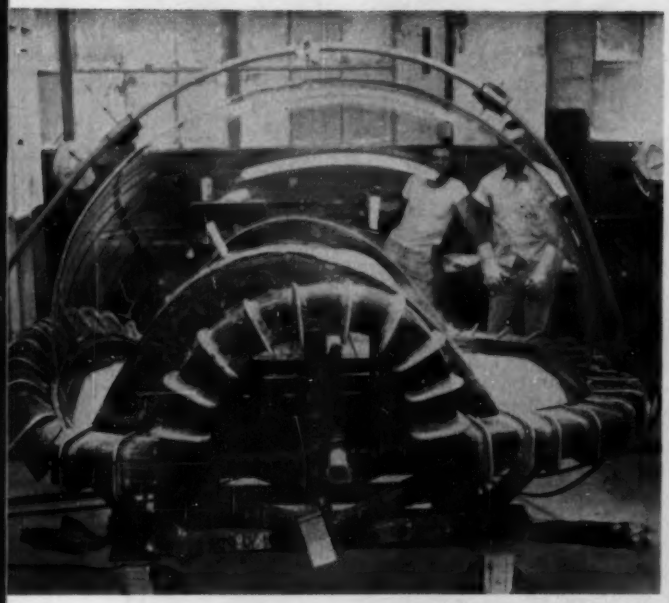
After blowing and inspection have been completed, the bubble is annealed by leaving it in an oven for 10 hours at 185 F. (Attempts to speed annealing by raising the temperature have caused the thick Plexiglas to distort). Annealing eliminates crazing and, possibly, haziness occurring during cleaning.

Overnight annealing

Normally, Bell blows its bubbles during the day, then puts them in ovens for annealing overnight. Next day, protective coatings are applied to protect the bubble during shipping.

But this business of blowing bubbles isn't as easy as it sounds. It has taken years of trial and error to determine the best heat, time and so forth. Yet, despite every effort to stay within these limits, trouble does crop up — sometimes because the sheets aren't exactly uniform in thickness, or sometimes they just don't respond to Bell's bubble-making formula.

Then there's the human element. Bell supervisors say that a two-man team can go along for three or four months turning out a high percent-



Clamped and sealed bubble is partially blown in oven to prevent wrinkles from forming in tight areas arounds seals

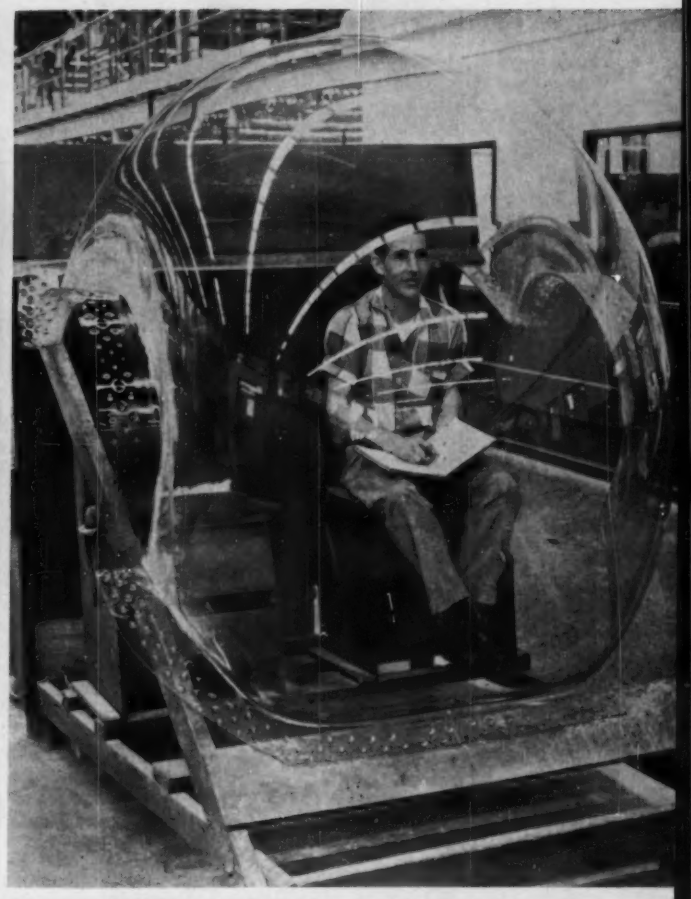
at Bell

age of defect-free bubbles. Suddenly, their reject frequency will blow sky high for no apparent reason. Checks will show the men are doing the job in the same way they always have, with no deviation from procedure, yet the rejects continue to mount. Incidentally, most rejected bubbles are salvaged by reheating and reblowing.

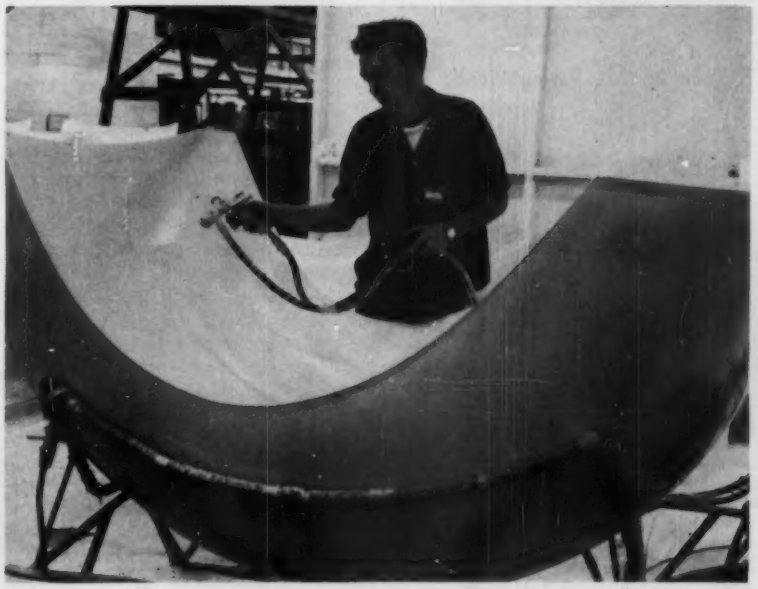
When rejects pile up, the old team is pulled off the job and a new one takes over. After a couple of weeks, the first team goes back and is as efficient as before. Only thing the Bell people can figure out is that fatigue is in some way accountable.

Coming: aluminum tooling

The fiber glass tool now used by Bell was developed at a time when company researchers were trying out fiber glass as a tool material. Future tools for bubble blowing will most likely be of cast aluminum, which is less likely to warp, and would cut tooling time. With aluminum Bell believes it can get over fiber glass's 350 F limitations, and at the same time cut down on cooling time. Eventually, Bell hopes to achieve a cooling time of 8 minutes, compared to the present 25-minute requirement.



After optical inspection, Plexiglas bubble is placed in this mockup of a helicopter cockpit, is then trimmed in place



Protective coating is applied to finished, annealed, and inspected bubble prior to shipment

Assembler racks up first of the U-shaped channels that will cover the thrust chamber. Design of channels puts the greatest cooling effect where it is most needed

Braze filler is sprayed on the ribbon-wrapped thrust chamber to help seal the coolant passages underneath. Unit in background is waiting for electro-grinding and wrapping

Ribbon wrapping makes thrust chambers

Channels get finishing touches before spotwelding. Ribbon wrapping will seal the channels so fuel coolant can travel from the neck down to the bottom in the short ones and from there up to the top in the longer ones

This new look in rocket thrust chambers comes from entirely new concepts in design and fabrication—principally the use of U-shaped channels for coolant passages. The open side of the channels faces outward and is enclosed by the ribbon-wrapped exterior.

Solar Aircraft Co of San Diego, Calif, is making the new chambers for the National Aeronautics and Space Administration. The company has brazed other regeneratively cooled thrust chambers for major missile and space-vehicle programs, but, unlike this one, they have been of the tube type.

The ribbon-wrap concept, conceived and designed by the NASA, offers an extremely lightweight, yet strong, chamber which provides greater design flexibility and costs less than other types of construction.

One of its main advantages is that the sheet-metal channels are a better means for distributing the coolant effect over the surface of the chamber. In addition, they permit a design that makes the fuel coolant flow at different velocities over different areas of the thin metal to meet local heat conditions.

In order to build these chambers, Solar had to solve a number of problems in precision forming, assembly methods, electro-grinding, and stretch wrapping. The company also employed some interesting new multiple-brazing and heat-treating techniques.

First of all, 360 straight strips are blanked out of 0.008-in. stainless steel (AM-350). Then a one-piece die forms the U-channels and shapes them to fit the outside of the thrust chamber. Half of these channels will extend only from the "neck" of the chamber to the bottom. The other 180 will run full length.

After the forming operation, the longer channels are assembled, open-side-out, to a cast stainless steel shell that has been machined to the desired hourglass shape. Then the shorter channels are installed, also open-side-out.

With their upper ends positioned just below the neck of the chamber, the short channels are clamped on top of the longer ones. Lower, where the chamber has a larger diameter, the short ones gradually feed in with the other 180 to form a single layer, or skirt.

In operation, fuel will enter the short channels from a fuel manifold that fits around the neck. From here it will flow to the bottom and then return through the longer channels to a fuel injector at the top of the chamber.

During the assembly operation, the channels are held in alignment by notched clamping devices. Then a welding operator makes about 100,000 spotwelds in a specific pattern to insure intimate contact between the coolant passages and the shell and to hold dimensional requirements. An annealing operation in a hydrogen atmosphere also hot sizes the channel to the shape of the shell.

Two special lathe jobs

After annealing, the chamber is put on a specially adapted lathe that electro-grinds the channels to specified heights along the entire chamber length. This precision grinding provides the accurate coolant-passage geometry necessary to the design concept.

Then, while still on the same lathe, the chamber is wrapped tightly with about 2650 ft of 0.008-in. stainless steel ribbon (AM-350, same as the channels). This ribbon, along with a ribbon of copper brazing alloy, is guided from one end of the chamber to the other by a special device mounted on the lathe's carriage and thus geared, through the leadscrew, to the chamber's rotation.

Following the wrapping, additional copper-braze filler is sprayed onto the chamber to provide external sealing of the interlocked ribbons. The chamber is then ready for brazing which integrates the wrapping and channels into tube-like fuel passages.

For this operation, the chamber is taken above 1980 F in about an hour in one of Solar's large 600-kw, elevator-type furnaces. The furnaces have multiple zone control, and a muffle maintains a controlled argon or hydrogen atmosphere.

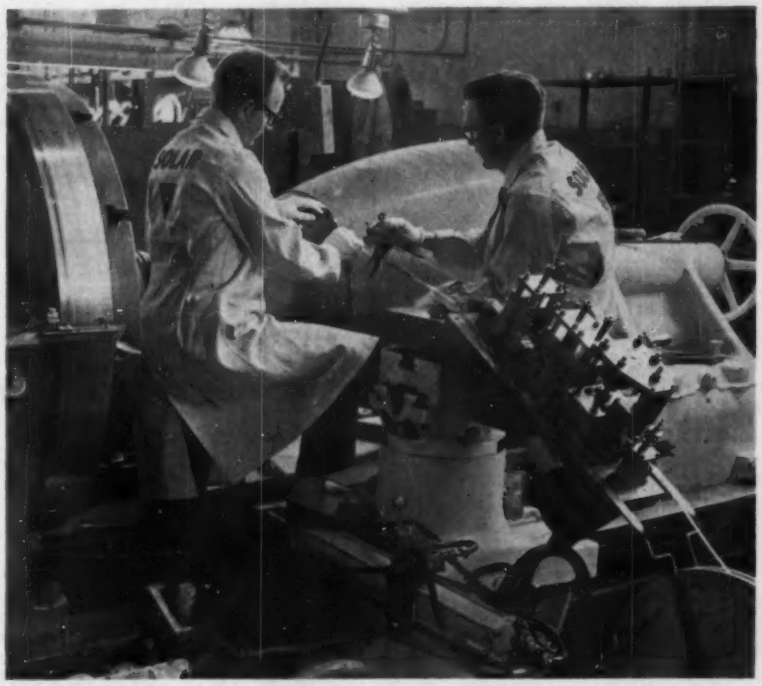
After brazing, the chamber is slowly furnace-cooled to 1800 F to allow unstressed solidification before it is removed from the furnace and air-cooled to room temperature. Protective atmosphere is maintained to insure a clean assembly.

Next, the multiple brazing techniques developed by Solar are brought into play. Hardware attachments such as fuel manifold, reinforcing rings, and injector flange are fitted to the chamber, and the second braze begins. With a copper-tin brazing alloy, brazing takes place at about 1875 F.

Then, after final machining, the assembly is heat treated to achieve the desired metallurgical properties in the precipitation-hardening AM-350. In a split cycle, the unit is held at –100 F for three hours followed by three hours at 1000 F.

Finally, the chamber undergoes a series of tests including a leak-pressure test with 200-psi helium in the fuel passages while the chamber is submerged in a water tank.

Adapted lathe electro-grinds chamber after spotwelding. This precision grinding holds channel heights to the accurate geometry required by the design concept



Chamber is wrapped with two ribbons—stainless steel ribbon and copper braze ribbon —as it rotates on same lathe that does the electro-grinding

AGMA's New President
James F Murray
President
Winsmith, Inc

VP, Technical Division
Folke Richardz
Consulting Specialist
Westinghouse Electric Corp

VP, Product Division
Charles F Bannan
Vice President
Western Gear Corp

Connell Award Winner
E J Wellauer
Director, Research & Development
The Falk Corp

Revised gear classification nearly ready

Voting is now in progress on the proposed gear classification manual for spur, helical, and herringbone gears. The proposed new manual, developed by committees of American Gear Manufacturers Association was first circulated for general discussion last fall (AM—Nov 16 '59, p134).

At the meeting of AGMA early this month there was considerable discussion of further changes, even though voting on a "final" draft has begun. These changes would probably involve only one table and one paragraph in the section on fine-pitch tolerances.

When the new manual is adopted, which now looks like early fall, the tolerance figures in existing AGMA inspection standards will be withdrawn and the tolerances in the new manual will apply.

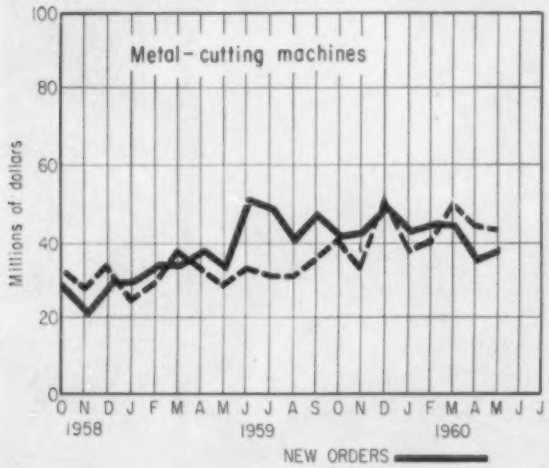
The new system will establish 14 classes of gears (Class 3 through Class 16) to replace the present four commercial classes and three precision classes.

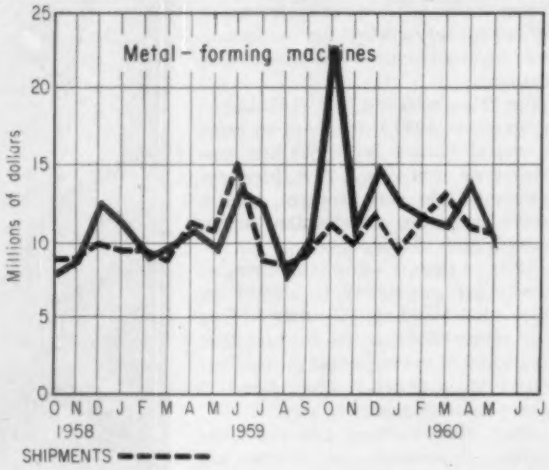
On fine-pitch gears, Class 11 and better, dual tolerance ranges are being established, one for gears up to 5-in. pitch dia and the other up to 10-in. pitch dia. Further revision in the tolerances of these gears may be made before adoption.

The manual is intended to simplify the specification and ordering of gears for most applications. It is expected that some special cases will require agreement on special considerations between designer, user, and manufacturer, but the system can absorb improvements.

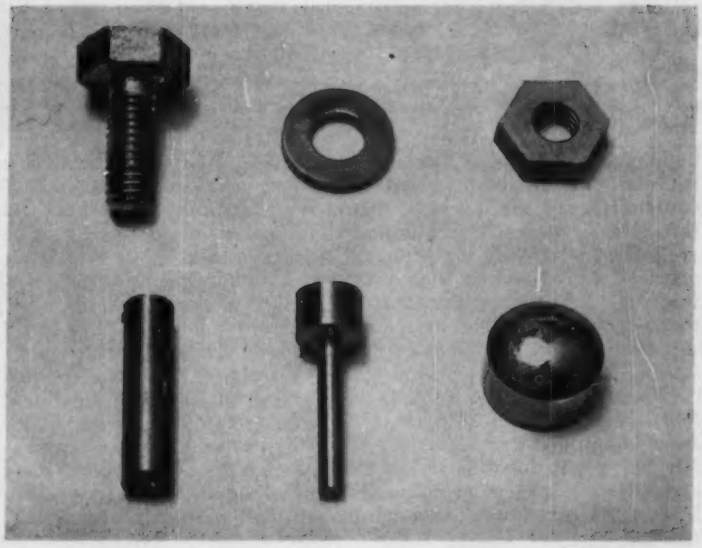
The Edward P Connell award, for "outstanding contributions to the development of the gear manufacturing art, particularly in the field of gear strength and durability ratings," was presented to E J Wellauer, director of research and development, The Falk Corp. In addition to the new president and the vice presidents (see above), J Harper Jackson, sales manager, Jackson Gear Co, Pittsburgh, was elected treasurer.

NMTBA Index of machine tool new orders and shipments





New orders for metal-cutting machine tools rose in May after dropping sharply in April, but shipments continued to decline, according to preliminary figures released by the NMTBA. Metal-forming machine tools orders and shipments dropped. Latest figures place net new orders for metal-cutting machine tools at $38,000,000, shipments at $44,150,000. April figures were $36,750,000 and $44,300,000. Net new orders for metal-forming machines in May ran to $10,700,000, shipments to $10,300,000. April figures were $14,900,000 and $11,050,000 respectively



Single crystals of refractory materials, such as the tungsten "boule" at the left, can be grown in a new arc-fusion process. The small parts shown above have all been machined from single crystals—the bolt, nut, and washer from columbium; the rod from vanadium; the others from tungsten

Giant crystals break a machining barrier

Machine tungsten at room temperature? No problem at all, if you work with the new single crystals just developed by Linde Company, Division of Union Carbide Corp. Also available in single crystal form are such metals as molybdenum, vanadium, columbium, and tantalum, and such compounds as titanium carbide, titanium monoxide, titanium sesquioxide and molybdenum desilicide.

The refractory metals, because of their resistance to heat, wear, and corrosion have long been recognized as having great potential for industrial and space-age applications. Until now, however, these materials have been limited in use because they are brittle, lack a clean, homogeneous structure, and are difficult to work because of extremely high melting points.

Linde's new single crystals contain relatively small amounts of impurities, and this, in turn, minimizes brittleness caused by inclusions.

Even more important, single crystals can be formed and worked at temperatures well below those normally associated with the refractory materials. And the crystals have essentially zero porosity.

Arc fusion process

A new, arc fusion crystal-growing process produces crystals as cylinders in diameters of ¼ in. to 1 in. and lengths of a few inches to over a foot. The single crystal (called a boule) of tungsten shown at the upper left is ⅝ in. in diameter and 12 in. long—and is worth about $1200.

No longer a laboratory curiosity, single crystals are being made in production quantities. In addition to the "as grown" boules, the materials can be obtained in fabricated shapes such as rods, discs, and the like, with ground or polished surfaces.

Machined parts

The small parts shown above have been machined from single crystals. From right to left, top row, we have a ½-in.-long, 10-32 hex bolt made of columbium. The thread was turned on a lathe; the hex head was milled to shape; and the top of the head was cut off from stock with a Carborundum slicing wheel. Next, a columbium washer which was cut off from a cylinder and turned with a diamond tool. The center hole was drilled with a carbide drill. The hex nut was tapped with a standard tap; the flats were milled with a carbide cutter; and the top and bottom faces were ground with a silicon-carbide wheel.

Across the bottom row, we have 3/16-in.-dia, ¾-in.-long vanadium rod. The body was diamond ground; the ends were Carborundum ground. The next piece is a tungsten electronic component. Its shoulder radius was Carborundum ground; its diameter turned down with a diamond wheel; its large flat (top) has been finished with emery paper. The last part is a 7/16-in.-dia tungsten dome. The dome itself was polished with aluminum oxide, the circumference with Carborundum.

Single crystals of tungsten are much more ductile and can be worked at much lower temperatures than presently available polycrystalline specimens produced by powder metallurgy or conventional arc melting. Experimentation with refractory metal single crystals will accelerate availability of wrought products in useful sizes, shapes and quality. Titanium sesquioxide is a high-temperature semiconductor. Titanium diboride (soon to be available) combines hardness, corrosion resistance, and electrical conductivity. Molybdenum disilicide has remarkably good high-temperature oxidation resistance.

The new crystal-growing process was developed by scientists at the Speedway Research Laboratory in Indianapolis, under the direction of Dr D M Gillies, assistant director of research for Linde.

Coil size, service, and mechanization. . .

Strip steel costs to compete

Eight years ago the Athenia Steel Division of National-Standard Co, Clifton, NJ, saw the last of its high-carbon-steel, umbrella-wire business go to Japan. One by one Athenia's markets for specialty steel strip went to overseas suppliers. Sweden took over what once had been a major business in razor-blade steel. German steel shaped our ladies with corset stays. And so it went. Direct labor costs of 12 to 18c per lb at Athenia couldn't compete with the few-cent-per-lb labor factor in foreign steel. Management wondered: Should the company close down or fight?

Today, new orders for umbrella wire, and for corset-stay strip, are going into Clifton. A development project is underway on high-strength alloy ribbon-wrap for missiles (see page 108). The competitive margin in other foreign products is steadily narrowing. Obviously, this management believed that its unique company, its 300 employees, and its importance as a source of special materials for US security was worth fighting for. What weapons did the company select?

High labor costs stood out as the number one target. A second target was delivery time. More and more customers, to avoid building large inventories at their own expense, are ordering smaller quantities at more frequent cycles and expecting virtually overnight deliveries.

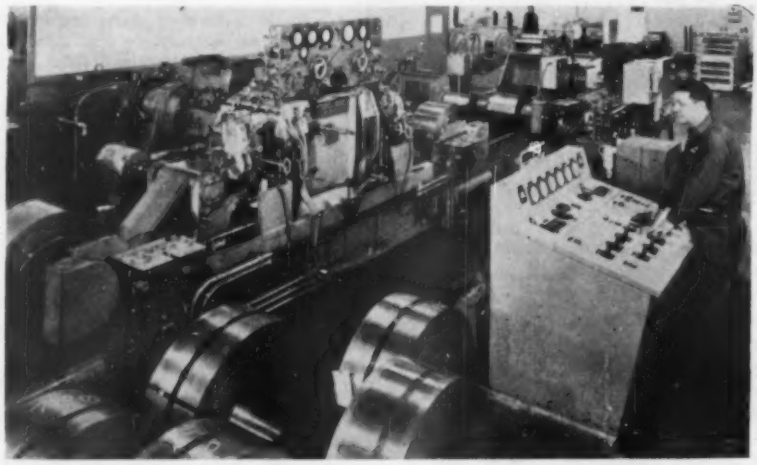
Equipment modernization (some machines were vintage 1900) was the answer to excessive labor costs. A $3 million equipment investment program has lowered this direct labor cost to an average of nine cents per lb.

Reorganization of Athenia's service concept, including additional sales engineers, warehousing and distribution facilities, and improved order processing culminated in an ability to deliver stock-size materials in 48 hrs. This ability is a rough one for foreign suppliers to meet.

Perhaps the most significant advantage resulted from the company's studies of both mechanization and service. It's *increased coil size*—a development that can mean substantial savings in the customer's labor costs; savings that frequently outweigh any cost advantage in imported steel. Instead of, for example, conventional 150-lb coils, the new equipment produces 500, 750, and 1000 lb coils in widths up to ½ in. and coils weighing up to 2000 lb in widths from ½ to 17 in.

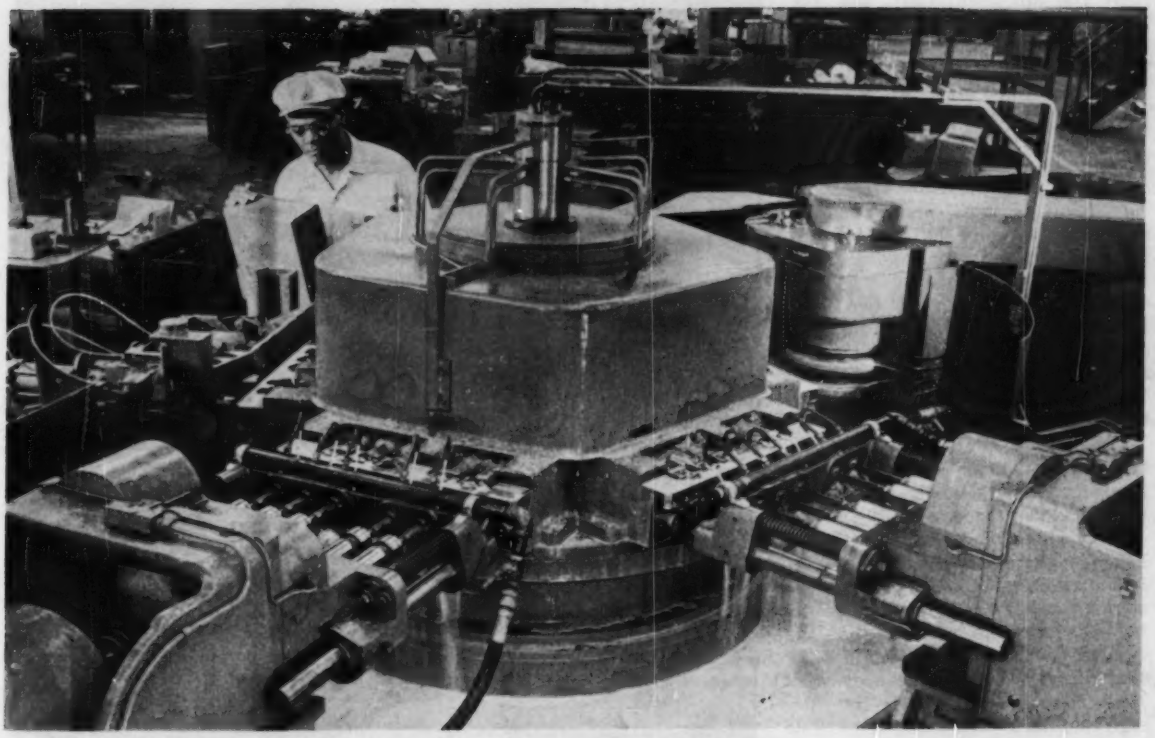
Manufacturers of springs, bandsaw blades, spatulas, pen nibs, fasteners, piston rings, razor blades, and thousands of other things made from high-carbon, cold-rolled flat wire and strip can keep their machines running from three to ten times as long without adding a new coil of stock. This continuity means as much as an hour or more per shift of man-machine time.

New equipment at Athenia, expected to pay for itself in three to five years, includes a 13-in. reversing-cluster Sendzimir strip-rolling mill, two three-stand flattening mills, a 24-stand continuous annealing line, and seven bell-type, nitrogen-atmosphere annealing furnaces having a total charging capacity of 3 million lb per month. With 50 hp per stand, the newest flattening mill runs at 3000 ft per min. Previous single stands ran at 250 fpm. The continuous annealing line increased productivity from 2000 to 18,000 lb per day per man.



Sendzimir reversing cold strip mill flattens high-carbon strip up to 13-in. wide and 0.065 in. thick to final thicknesses of 0.00125 in. With 500 hp on mill, and 400 hp on each winder, normal production speed is above 1000 feet per min.

Annealing furnaces provide capacity of 3 million lb per month. Dissociated ammonia is used to produce nitrogen atmosphere. Furnaces will accommodate steel coils 5 ft in diameter stacked 10 ft high; are built on concrete sunk to bedrock



Part design cuts tooling costs at Chrysler-Trenton. Here, separate die-cast aluminum rocker-shaft brackets are milled, drilled, and reamed five at a time in this five-station Biltrite setup. Two different kinds of brackets are machined simultaneously in this setup—because three of one kind and two of another are required in each cylinder head. Parts are automatically unloaded into chutes which segregate the two kinds of brackets. Production rate: 600-plus units per hour

Chrysler V-8's have much in common (85% of all parts) ditto sixes as...

Share-the-parts plan cuts engine costs

By George DeGroat, Detroit editor

Chrysler's big squeeze play started about three years ago, when word came down from the front office to consolidate engine-building facilities into two instead of six plants, and at the same time to find as many common parts as possible for the 120 different engines, or engine combinations, that go into Imperials, Chryslers, DeSotos, Dodges, and Plymouths.

Cuts capital outlay

The plan has succeeded handsomely. Today, most of the parts that go into various V-8 engines are the same, and this also holds true for sixes. As a result, capital investment has been cut drastically, and at the same time many production problems have been smoothed out.

At Chrysler's Trenton Engine Plant, where all engines except V-8's for Plymouths and Dodge Darts are made, manufacturing methods are completely coordinated with product design features.

For example, all of the components of V-8 engines for Imperial, Chrysler, DeSoto, Dodge and Plymouth cars, and for truck, marine and industrial V-8's, have about 85% common parts. This same ratio holds true for 6-cylinder engines for the Valiant, Dart and Plymouth, also built at Trenton.

Among the V-8's common parts include bearing caps, camshafts, connecting rod caps, chain case covers, right- and left-exhaust manifolds, oil pump bodies (and their components), valve rocker shafts, water pump housings and bodies, plus many others. Parts that necessarily differ from engine to engine include connecting rods, crankshafts, intake manifolds, and cylinder blocks and heads.

Because Trenton produces more than one million engines a year, and a consequently large number of common parts, unit cost per piece is 'way down, and tooling costs are kept low. The number of different patterns and molds for cast parts is also low and, of course, production line tooling is considerably simplified. An added advantage in making the same parts for different engines: Production is less apt to be disrupted when one machine or a line is down —because others are making identical parts and can take up the slack.

Flexible lines

Chrysler's Trenton facility is capable of producing more than 1.5-million engines a year. Major production lines include four for bearing caps, four for crankshafts, four for connecting rod caps, and four for connecting rod assemblies. Trenton also has six lines each for machining crankshafts and cylinder heads, four for cylinder blocks, and two engine assembly lines.

Other lines: three 6-cylinder engine exhaust manifold lines, two for V-8 exhaust manifolds (one each for

right and left manifolds), and five intake manifold lines. Add to these: two lines for oil pump bodies, six for pistons, three for rocker shafts, four for water pumps housings, and four for water pump body lines.

A high degree of flexibility has been designed into each line. For example, the line for machining right-hand exhaust manifolds can also rough-machine left-hand manifolds in the event the left-hand line is down for any reason.

Another example: The two lines for machining crankshafts for two different 6-cylinder, inline engines each have machines which are fully interchangeable, except for those that rough and finish crankpins.

Such use of similar equipment in two different lines cuts tooling and fixture costs drastically, and saves valuable floor space.

Of the five block lines, only one is needed for the two different 6-cylinder engines—because product design is coordinated with manufacturing. Taking into account that the deepest hole required is a block, or the longest milling cut needed would limit the capacity of the line, design engineers shortened some hole depths and lengths of cut so that both blocks could be economically machined in the same equipment. In addition to making production equipment more flexible, this coordination increases production rates.

Another interesting feature of these lines: all cast iron parts are machined wet—including engine blocks, cylinder heads, exhaust manifolds, intake manifolds, oil and water pumps, and main bearing caps. Wet machining results in longer tool life and more consistent product quality. Constant cooling of tools allows for faster cutting speeds, with corresponding higher output, and it assures a virtually dust-free plant atmosphere.

Transfer machines are eliminated on this main bearing cap line, where a rotary indexing machine and three single-station units drill, ream, mill, chamfer, spot-face, and part the castings. Production rate is around 200 per hour. One operator runs the indexing machine and loads the spotfacing setup. Another operator runs two machines for sawing the clusters apart.

Camshafts are clamped once in this nine-station Natco trunnion machine, which mills to length, drills, roughs and finish-reams centers on each end—and drills and reams manufacturing holes. Usually, camshafts are milled and centered in the foundry, but Chrysler gets better accuracy by doing it on the production line. Parts go around twice to cover all operations with no extra stations. Production rate is about 100/hr

Mechanized materials handling

Serving the widespread wet machining operation is one of the largest and most elaborate cutting tool coolant systems in the automobile industry. This network actually consists of 26 separate systems, pumping 36,800 gallons of tooling lubricant a minute through overhead piping and returning it by underground passages to 10½-ft-deep tanks.

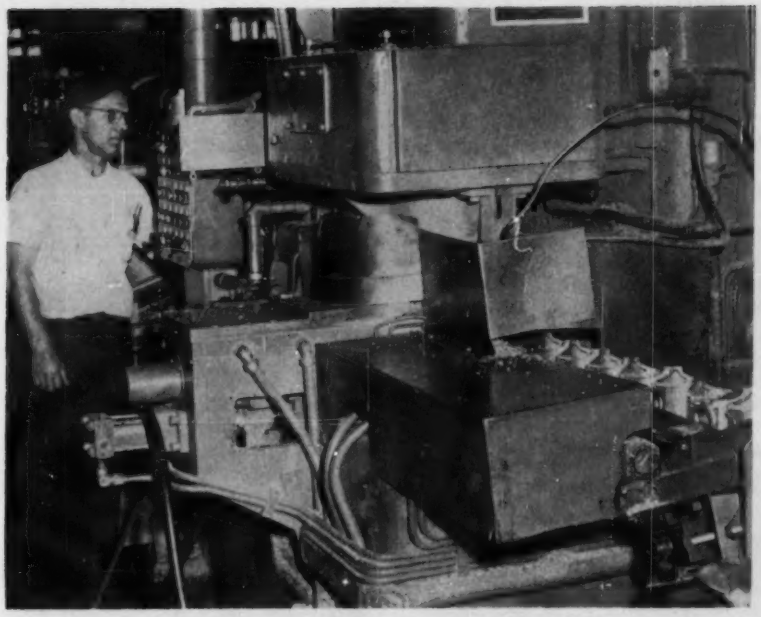
The coolant settles in the tanks for a cleaning period of 6 to 15 minutes—depending on the size and type of chips being handled—before returning to the tooling area.

Throughout the plant, a well-integrated flow of materials and parts is maintained by a 27,700-ft overhead monorail system made up of 37 conveyors. This system delivers all major machined parts to the final assembly lines. A 2800-ft power-and-free conveyor line system moves the engines to and from weight-balancing units during engine assembly operations. The same system later carries assembled engines to the hot test "merry-go-round" and then on to the shipping areas.

A 3260-ft underground chip disposal system, serving 287,000 sq ft of the plant, is installed under the concrete floor throughout the entire machining area. Consisting of 17 underground drag and two overhead belt conveyors, the system can deliver 150 tons of cast iron chips and 45 tons of steel chips to railway cars during a 16-hour (two-shift) work day.

New techniques

A number of manufacturing innovations not found in other automobile engine plants have been established at Trenton. One of these is an automatic grinding operation that eliminates finish boring and honing of wrist-pin and crankpin holes to con-



Critical dimensions are held on piston skirts and wrist-pin holes by avoiding distortion usually caused by rough machining. In this Lamb machine, weight pad bosses on pistons are rough-milled first to remove scale, then a small amount of stock is weight-milled in the final operation. Parts are oriented before entering the machine on transfer bars, and are automatically unloaded

necting rod assemblies for V-8 engines. After holes are semi-finish bored in Ex-Cell-O machines, the assemblies go into special Heald grinders for finish grinding to size. While one machine grinds and inspects wrist-pin holes, another does the same with crankpin holes.

In another unique setup a Buhr rotary indexing machine and three single-station machines drill, ream, mill, spotface, and part main bearing cap clusters. (Usually, this is a transfer machine setup.) As in conventional setups, joint faces and half-round sections of the casting are broached first. But then they are loaded into the Buhr dial machine (located on the side opposite the broached surfaces) for drilling and reaming bolt holes through the casting from the joint side. Lock slot corners in the half-round section are milled and chamfered in this machine, too.

A Buhr single-spindle machine is employed to spotface the bolt seat side, and a pair of single station machines saws the clusters apart. Cost of this setup was less than that of two transfer machines, which would have been required to meet the same production rates.

By using separate die-cast aluminum rocker-shaft brackets instead of designing these parts as integral sections of cylinder heads, Chrysler can use more generous tolerances in drilling and reaming rocker-shaft holes. Usually, as part of the head, these holes require such accuracy that they are line reamed. At Trenton, a special Biltrite 5-station rotary indexing machine drills the bolt holes and drills and reams rocker shaft holes in five parts at a time.

Another departure from conventional practice: qualifying of V-8 engine blocks prior to broaching from *both* banks by probing through welch plug holes between the No. 2 and 3 cylinder bores on right and left banks.

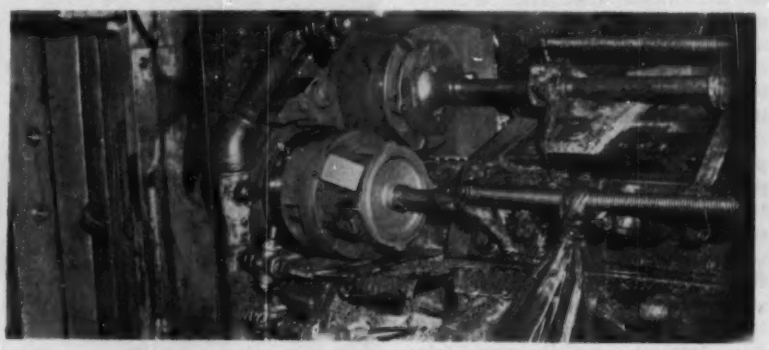
In this setup, a qualifying pad or spot is milled on the side of the block for drilling and reaming manufacturing holes later. These holes locate the block in subsequent machining operations. By qualifying a block from both sides, its position is equalized relative to cylinder-bore core shift in casting. Usually, probing is done from one side only, but equalization is then difficult because of problems in holding cylinder wall thickness tolerances in casting.

Oil pump bodies have been so redesigned as to eliminate need for expensive transfer machines. Instead, a Baird chucking machine does the job. The old oil pump body assemblies were mounted inside the oil pan, and attached to the engine either through the No. 4 or No. 5 main bearing cap.

Now, the assembly is mounted outside the oil pan and is attached to the cylinder block for better servicing. Part geometry allows the assembly to be located against the cast cover face in the Baird machines—as chuck jaws grip the outside contour. In these machines, stem OD's are semi-finish turned, mounting faces are rough and semi-finish faced, and rotor stem holes are drilled and semi-finish reamed.

Many other operations at Trenton differ from conventional practice. For instance, the plant ships engine "assemblies," rather than power plants. An assembly is shipped without such components as starters, generators, and transmissions. This greatly simplifies scheduling of engines from Trenton to assembly plants, which not only add the starters, generators and transmissions, but can also add the wide variety of accessories required on various engines.

Not only that, Chrysler's system of shipping assemblies cuts down on complex inventories formerly maintained at assembly plants, where accessories are now installed on engine assemblies only as required.



Chucking machines instead of transfers can be used in machining cast-iron oil-pump bodies as a result of part redesign. Initial cost of these machines is considerably less than that of transfer machines, and production rates are about equal—over 100 pieces per hour

Mixed scrap won't bring top dollar

By Robert H Clymer, president, Clymer Associates, Inc, Reading, Pa

It's getting more difficult every year to find buyers for mixed turnings and borings. But if you know the score you can realize more money from the sale of scrap.

The dwindling demand for mixed turnings and borings comes about for two reasons:

- Steel producers are using a lower ratio of turnings in charges because of new ore treatment and steelmaking processes, and
- Fabricating shops are generating more scrap than the market will absorb.

So prices are not attractive. Mills in the steelmaking centers pay only $15 to $20 a ton for turnings and borings, and the "scrap producer" gets several dollars less. And buyers, if they exist, in centers like Boston will pay only $8 to $9 a ton.

But you don't have to dump scrap, as some people have been forced to do. Here's the score: (1) generate less scrap by following the policy of "If you don't put it on, you won't have to take it off," and (2) upgrade the quality of the scrap that you do produce.

How? First, place responsibility for administering your scrap program in the hands of one person, preferably someone of executive caliber. Give him authority to conduct an in-plant education program. Require him to arrange for placement and collection of bins or tote boxes, and to see that turnings and other forms of scrap are properly segregated and processed.

Will the bother pay off?

Mixed borings and turnings are the poorest grade of scrap for good reason. Oil, dirt, trash of all kinds are mixed with, thrown into, or swept up with chips. Management should educate personnel to use chip bins for chips only. Signs painted on bins are helpful.

See that different kinds of steel chips and other metals are segregated in the proper bins. Mild steel turnings mixed into cast-iron borings give a lot of trouble to a steel mill.

Grinding chips, or swarf, are taboo. Never include them in a scrap shipment.

These are the categories that a steel mill or a scrap merchant likes to get:

"Heavy turnings," such as clean chips, generated in machining axles, shell or forgings, are prime. They are worth $10 to $15 a ton more than ordinary turnings and borings.

"Clean cast chemical borings" are clean, dry, cast-iron borings worth $10 more per ton than common borings. Chemical plants use this grade of scrap. They don't want stuff that contains moisture or oil to cause spontaneous combustion.

18-8 stainless turnings are worth $100 per ton. Throw in some carbon steel chips and you lose about 85% of the value of clean, segregated turnings. Mix in some aluminum chips, and you get nothing.

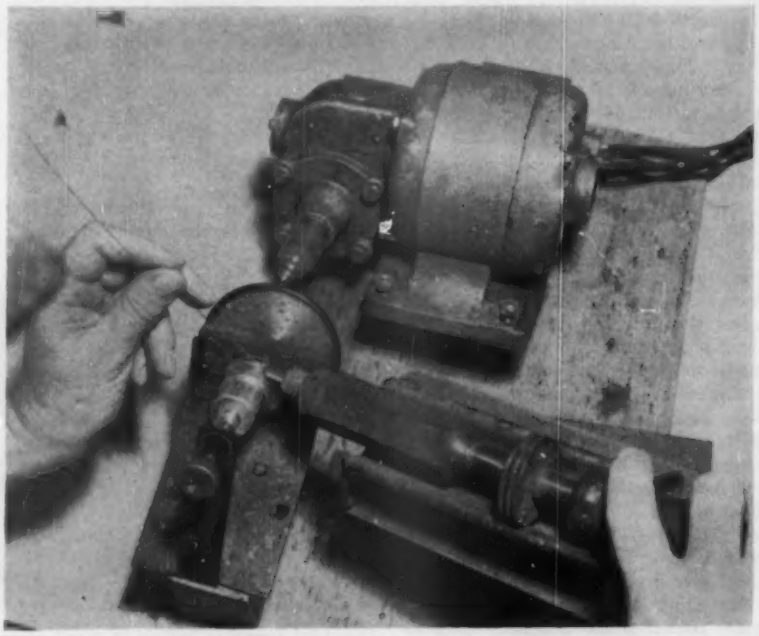
If you generate clean scrap, the word will get around. When dealers or mills know you do this, you are more likely to find a buyer.

Simple tooling is a first step toward mechanized soldering

Speed, low cost, and smooth solder flow are the advantages of a unique soldering technique applied by Newark Controls Co, Bloomfield, NJ. Solder makes a hermetical seal on the cover of a precision gas-density switch. The cover is assembled, crimped into position, then soldered to provide a hermetic seal.

A nest that holds the part snugly is powered by a pedal - controlled electric motor that friction-drives a rubber-tired wheel. The cover is held in position by a spring-loaded clamp. The industrial soldering iron is held against the work by an adjustable stand. Work is rotated through four revolutions slowly to preheat the cover, then solder is applied during the fifth rotation. Total time is three minutes; work force is unskilled labor.

The soldering iron is held against the work by hand pressure, and the solder is hand-fed. Hermetic seal is insured by complete solder penetration into the switch-cover joint, which in turn is insured by complete work preheating. Gear reducer cuts down motor speed.



Soldering fixture works like a small lathe, with a headstock work nest and a spring-loaded tailstock. Friction drive is sufficiently strong and uniform for hand soldering

Knurled thumbwheel rotates fixture as memory-core wires are hand-wrapped on terminal pins. Fixture arm is hinged so work can be tipped over to immerse pins in solder pot to hold wires permanently

Hand assembly holds precision on computer parts

Indexing board gathers memory-core housings after serial numbers are printed at small bench press. Board indexes as each slot fills; then stops as last slot fills

By F R McElligatt,
supervisor of plant engineering,
Schaefer plant, Burroughs Corp, Detroit

Hand assembly is definitely passé —or is it? One place you'll still find plenty of hand work is in computer manufacturing—the same computers that are often integral parts of elaborate automation systems. The reason: No machines so far developed can handle the intricate manipulation necessary for small subassemblies that go into electronic gear.

Burroughs has a good example of still-necessary hand assembly in its memory-core unit; a toroid core wound with permalloy tape and encased in a nylon jacket. The core is only about ¼ in. across, and is fitted with four delicate wire coils. The coils can be machine wound because coil-winding equipment has been highly developed, but most of the following operations are by hand.

Core assembly

Each core is hand-loaded into the central cavity in a plastic-molded

square housing, then clamped in position with a plastic wedge. Plastics are useful here because their electrical properties will not interfere with the low-voltage coils.

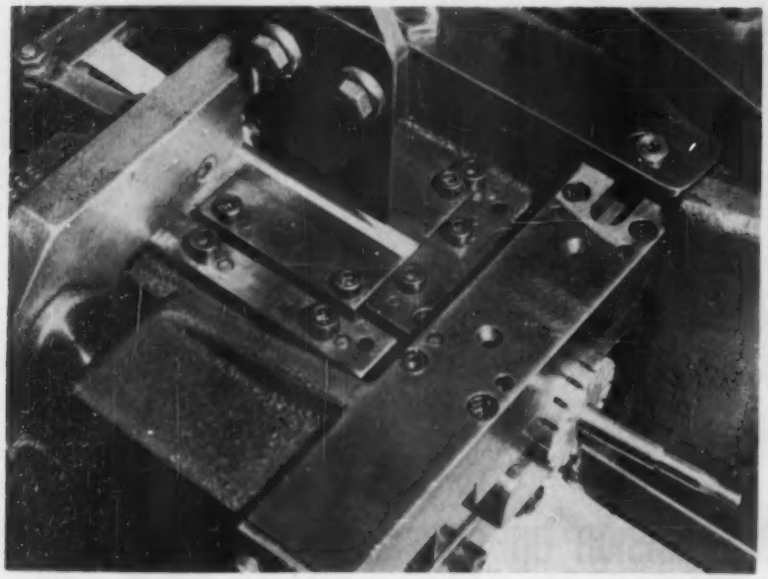
Each housing has 12 terminal pins imbedded around its periphery, and the wire-coil ends must be brought out from the core and hand-wound on the terminals in order. Housings are loaded individually on a hinged fixture for terminal winding, then the fixtures are turned over to dip the pin ends in a solder bath that makes a permanent electrical contact at each pin. Thin plastic insulation on the wires is burned away completely at soldering temperature to expose the thin copper wires for tinning.

Each housing fits into a plastic box —or case—that has previously been serial-numbered at a semi-automatic printing press equipped with automatic feed and switch-controlled unloading (see photo).

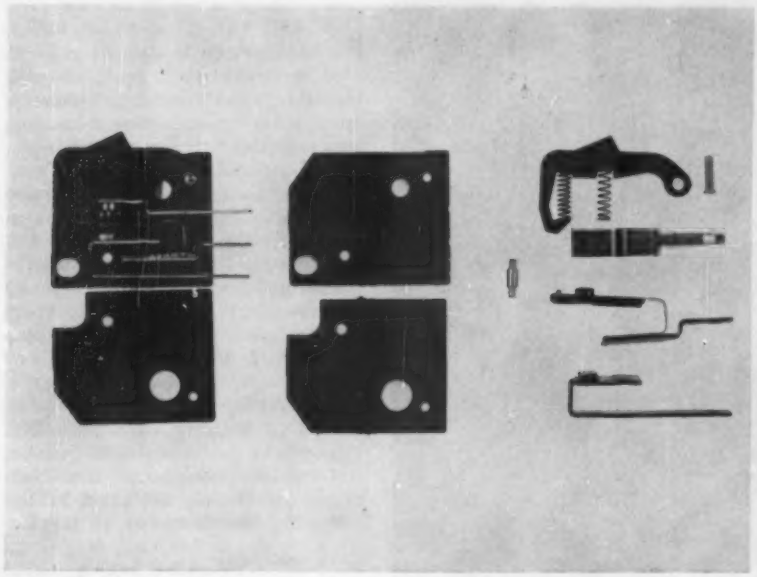
Last operation is to pot (encapsulate) each core by pouring quick-curing resin into the open end of each case. This stabilizes the assembly mechanically and makes it strong and impact resistant.

Motor assembly

Small motors that drive typewriter carriages and computer mechanisms are required in larger quantities, so production is more mechanized. In addition, motor assembly



Armature insulating machine grips rotor as insulating paper feeds to depth from a roll and is cut off. Armature is indexed from behind, then clamped between split jaws. Paper is V-formed as it feeds from roll to line rotor slots



Small switches are hand-assembled, then staked at electric-powered solenoid press with adjustable stroke. One rivet is pre-headed to grip the subassembly

has gone through considerable improvement over a long period of years. Many sizes are made in the same basic design and on the same machines.

To protect windings, rotors are fitted with insulating paper in the slots. This is inserted from a reel by a machine that creases the paper and drives it into a rotor slot, then shears the paper off. Rotors are indexed, then clamped, and another section of paper inserted in the next slot. The only regular operator attention required is to load new paper reels and to load and unload rotors. Coils are then machine-wound on the rotors and terminal wires are soldered to the commutators.

Switches

Small switches that operate typewriters, accounting machines, and computers are hand-assembled with simple bench tools. The switches consist of three beryllium-copper contact springs inserted in plastic-molded ribbed housings and fitted with coiled springs that normally hold one circuit closed; another open. These are made in fairly high quantities — 750 per day — but not high enough for automatic equipment.

The contact arms are hand-loaded, then the coiled springs and plastic actuating arm inserted. A rivet through the arm is staked at a bench press, then the plastic cover added, then two rivets staked.

Portable dimpler gets into tight spaces

Single-spindle dimpling—without a C-frame tool to provide axial pressure—is being performed by Boeing Airplane Co, Seattle, to finish up aircraft skins during final assembly. The new tool, developed by Hubert Schmitt, works through a drilled hole and uniformly depresses a section of metal so that a rivet head will fit flush with the wing-skin surface—for aerodynamic smoothness.

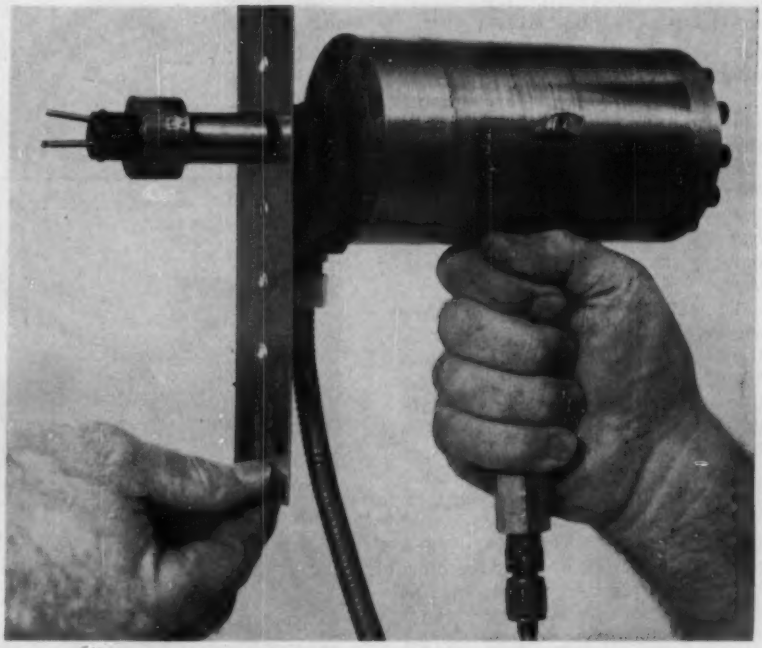
Dimpling is usually done early in wing-skin production when all sides of the wing skin can be reached easily. But for modification and repair work, or in final assembly, it is often impossible to get normal dimpling tools into the wing structure, or to work more than 6 in. or so in from a panel edge with a C-frame tool.

The dimpler is a 6-lb hydraulic ram coin-dimpler that will form depressions for 5/32 to ¼-in. rivet diameters in 0.02—0.064-in. 7075-R6 and 2024-T4 aluminum alloys. It includes a pull shaft, or mandrel, that will enter a small drilled hole, and to the end of which can be quickly attached a splitnut collet and dimpling die. The die works on the side of the sheet stock opposite the tool, which pulls the die to make the dimple.

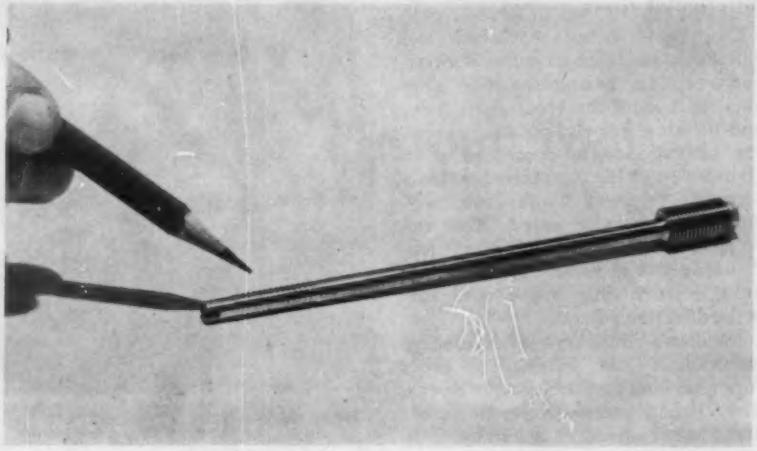
The mandrel is H-11 tool steel, capable of pulling with 4-ton force, and fitted with a large thread at one end to fit the ⅜-24 NF tool nose and with a shallow (0.005-in.) thread at the thin end to accept the die collet.

Pull action is two-stage; first pressure exerts a pre-set squeeze, and the final pressure brings the forming die into contact with the work, and to full depth.

The tool also does tube dimpling, with the tool itself on the outside of the tube, and the collet and die loaded on the mandrel from inside the tube.



Portable dimpler works through a pre-drilled rivet hole something like a back spotfacer. Power unit pulls mandrel and forming die, and pushes fixed die at end of nose



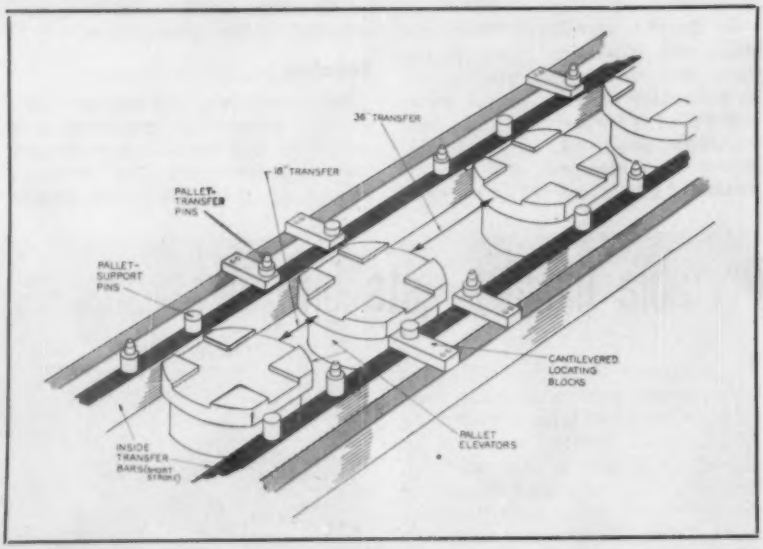
Double transfer cuts pallets, keeps accessibility

One of the major conflicts in transfer-machine design, tooling accessibility vs minimum fixture pallets (for lower initial cost), is partly resolved in a 23-station machine that will produce differential cases for a small European car. The point is this: To give maximum accessibility to station tooling, idle stations are necessary in a transfer machine. But each idle station requires an extra fixture pallet; costly and non-productive.

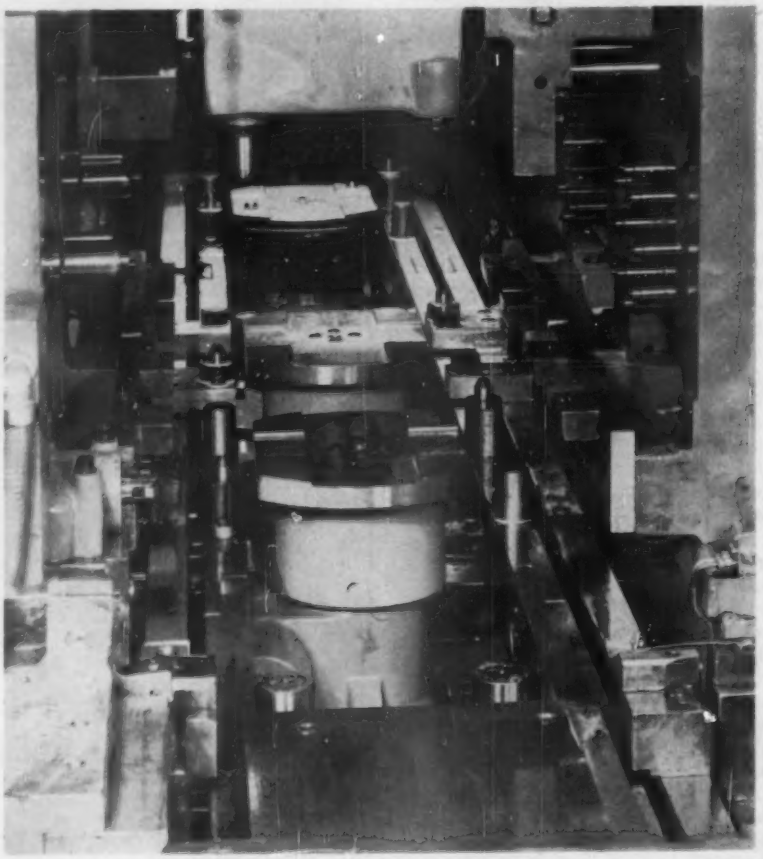
In the final design of this Transfer-matic, built by The Cross Company, Detroit, work stations are grouped in two's with access space left between groups. This one simple idea eliminates a third of the usual pallets.

To allow this spacing, workpieces must be moved different distances as they progress down the line. Double transfer bars are the answer; an inside transfer bar indexes 18 in. for the short stroke between adjacent stations, and an outside transfer bar indexes 36 in. to cross the access space.

To make sure the pallets always center at work stations, the outside transfer bars are equipped with cantilever blocks whose transfer pins line up with the transfer pins mounted on the inside transfer bars. After transfer, the pallets are elevated and precisely located by pins suspended from the overhead tooling bridges. The transfer bars shuttle back and forth without rise and fall. They start their motions at the same time, but the outside bars travel twice as far as the inside bars. The new transfer arrangement is responsible for reducing the investment in fixtures by 35%.



Locating blocks on outside rails carry pins that line up with pins on inside rails. All fixture pallets are retained on machine centerline



Fixture pallets index 18 in. between adjacent stations, then 36 in. to next station. Space between stations allows easy maintenance, tool change

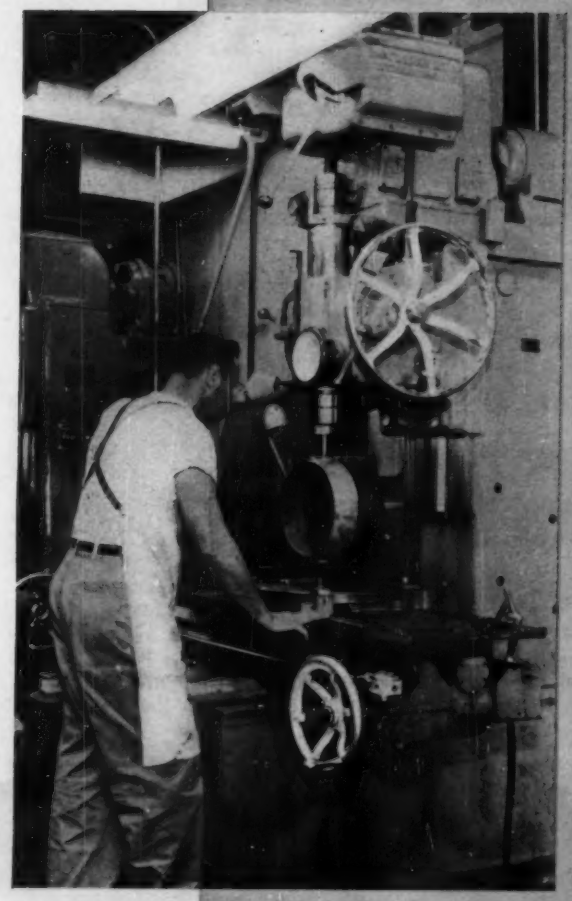
Differential cases

The parts being machined are flanged cases that require drilling and reaming, boring the side gear pockets, boring the cross-shaft hole, and forming spherical seats. Because the operations are combined in a transfer machine, combination tools formerly required on separate machines can be eliminated. This results in simpler tooling, lower tool-grinding costs, more rugged cutter design, more chip space, and improved surface finish.

European industry is embracing automation just as eagerly as is America, and for the same reasons. They want to reduce production costs and improve product accuracy.

How to machine MOLYBDENUM

Now that the novelty has worn off molybdenum as a material to be machined, there is considerable more data available on fabricating techniques than at the time of our first Special Report (AM—Sept 24 '56, p 149) on the subject. Here, from five shops experienced in working this high-temperature metal, vital to aircraft and missile parts, are the best, latest techniques on turning, drilling, grinding, chemical milling, electric-discharge machining; plus the latest on the best possible tool angles.



Precision jig-boring operation cuts holes in forged molybdenum missile parts. Wall thickness is held to ±0.001 in., and maximum total tolerance to ±0.005 in. on two passes through the flare throat

American Machinist / *Metalworking Manufacturing*

Special Report No. 491 • June 27, 1960

Experimental machining at Custom Tool

By Ray Williams, plant superintendent, Custom Tool & Mfg Co, Minneapolis

Skill of the mechanic is most important where experimental parts are being machined in molybdenum. Judgment by the machinist is the critical factor when the work starts to glaze over; when the operator must immediately back off the tool, replace it (because a glazing tool most likely has the start of a built-up edge), and continue the cut with reduced feed.

On a large variety of parts ranging in diameter from ½ to 20 in., and all with complex contours, our shop has noticed only minor differences between sintered and arc-cast molybdenum as far as machining techniques go. The sintered material is a little more abrasive and perhaps allows slightly shorter tool life. The low alloys, such as molybdenum—0.5% titanium alloy, machine about the same as unalloyed molybdenum. But as tungsten content increases —such as in molybdenum with 30% tungsten up to pure tungsten—the difficulty of machining increases.

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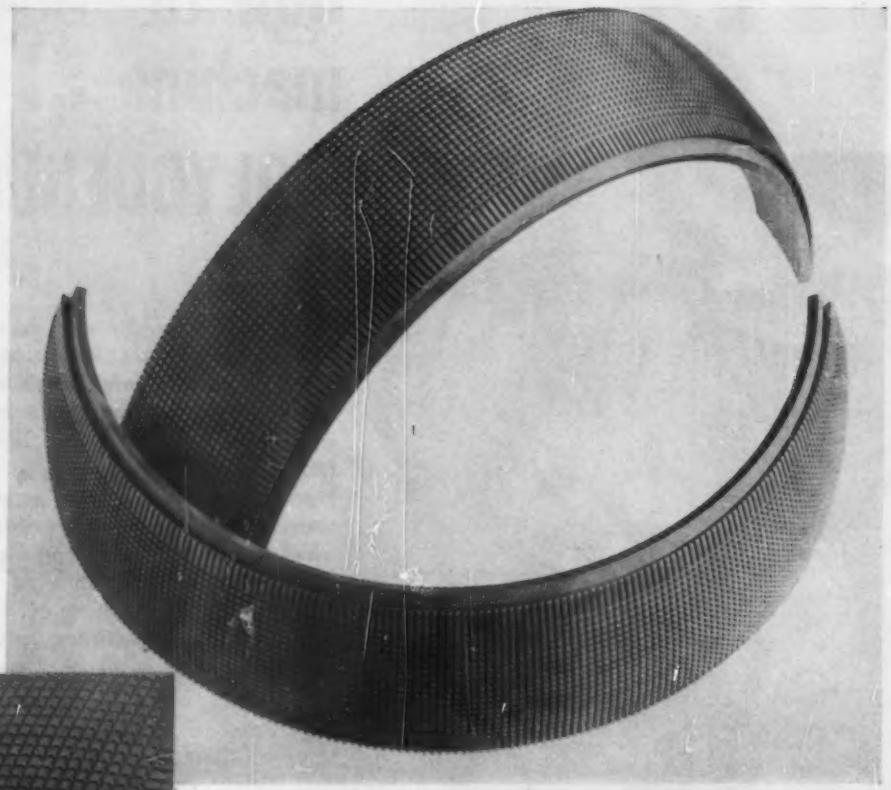
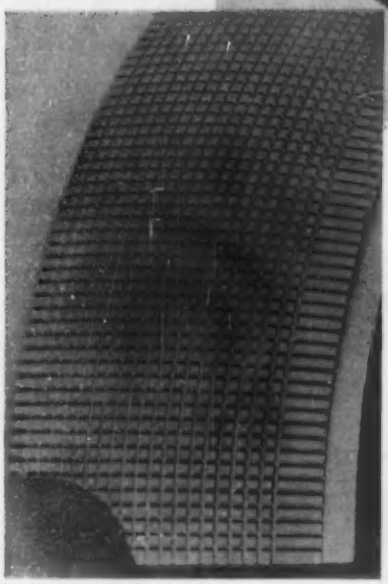
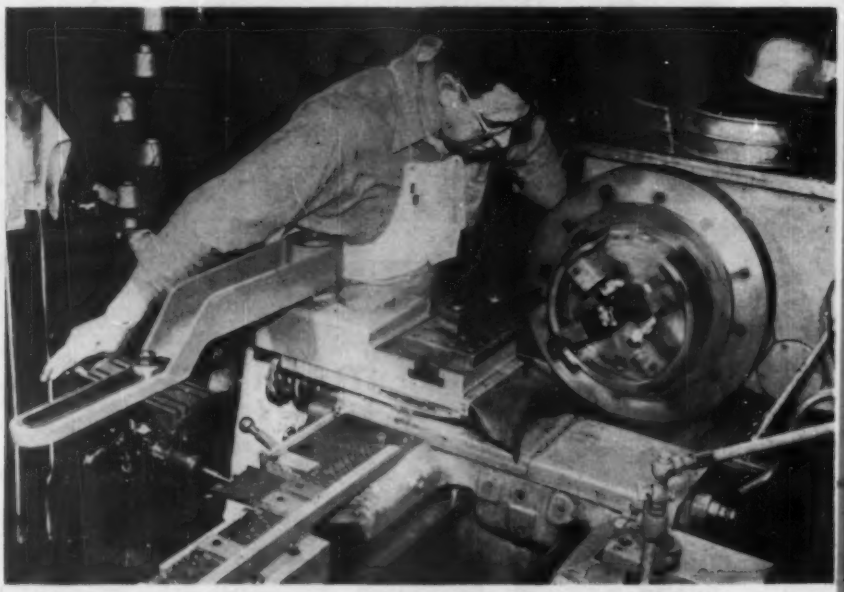




Solid-propellant missile parts were machined from unalloyed arc-cast molybdenum



Tracer lathe copies intricate contours with carbide-tool, special templet follower. Custom setup was made to provide greater rigidity and improved angular control than was possible with conventional equipment

Most machining operations on unalloyed molybdenum and the low alloys are fairly easy. However, threading is a problem because galling, tearing, and glazing are encountered, particularly on light cuts. Stress relieving before machining of any type is essential, especially with large forgings, to prevent cracking when the residual stresses are relieved non-uniformly by metal removal.

Cutting conditions

Here are some starting points; machining recommendations that provide a base to work from, but which may not be the exact answers required for the particular job on hand. These figures are for unalloyed or low-alloy molybdenum (0.5% titanium). The same tool geometry can be applied to molybdenum-tungsten alloys, but feeds and speeds should be dropped by 10-15% for 30% tungsten alloys and by 20-25% for 50% tungsten. Tool mortality will be higher for the tungsten alloys.

About coolants

One point about coolants: Because of the high value of molybdenum scrap, we take all possible precautions against chip contamination. Therefore, coolant is applied only for threading where it is essential. We also guard against oxidation of turning chips, which may result if there is not enough clearance on the tool.

We use friction bandsawing when convenient—a bandsaw blade with high-carbon, tip-hardened teeth. If this is not practical, we use a conventional hacksaw with a standard molybdenum HSS blade with 16 tpi and alternate offset. The stock is not normally heated for cutoff, but in winter we let it come up to normal room temperature before cutting.

Turning practice

Sintered carbide tools cut molybdenum—HSS is seldom applied except for assemblies with both molybdenum and steel parts. Recommended cutting conditions and geometry are:

	Roughing	Finishing
Speed, sfpm	100-200	300-600
Feed, ipr	0.006-0.008	0.006-0.008
Depth, in.	⅛-¼	0.015-0.020
Back rake	5-10°	0°
Side rake	12°	12°
Clearance	10°	10°

We normally apply Carboloy 883, but K7 is also good, and almost any kind of carbide suitable for cast-iron machining will give satisfactory results. A chip curler is desirable on both roughing and finishing tools. Preset tools are used so we have precise control over the tool geometry to avoid excessive wear and marks on the work when tools are changed in the middle of a cut.

One thing to watch on many aircraft and missile parts, which often run to thin sections, is distortion due to chucking pressure. We try to chuck on the heaviest sections and use light gripping pressure.

To eliminate glazing, we leave at least 0.010-0.015 in. for finishing. With this practice, it is possible to achieve a finish of 16 mu-in. rms.

Threading is a problem

Machining threads is difficult, but necessary, because other methods such as rolling or electrical discharge are either unsuitable for fine finished threads or too slow. For rough threads, we use these conditions:

Speed, 70-125 sfpm
Feed, ipr—0.006-0.008
Back rake—10°
Side rake—5°
Clearance—10° leading edge, 3° trailing edge.

Tools are Carboloy 883, and air blast is the coolant.

For finishing fine threads or for shallow threads, grinding is more practical. The wheel is a general-purpose type with 32—60 grit, taking a plunge cut of 0.002-0.010 in. Water-soluble coolant reduces the tendency toward checking.

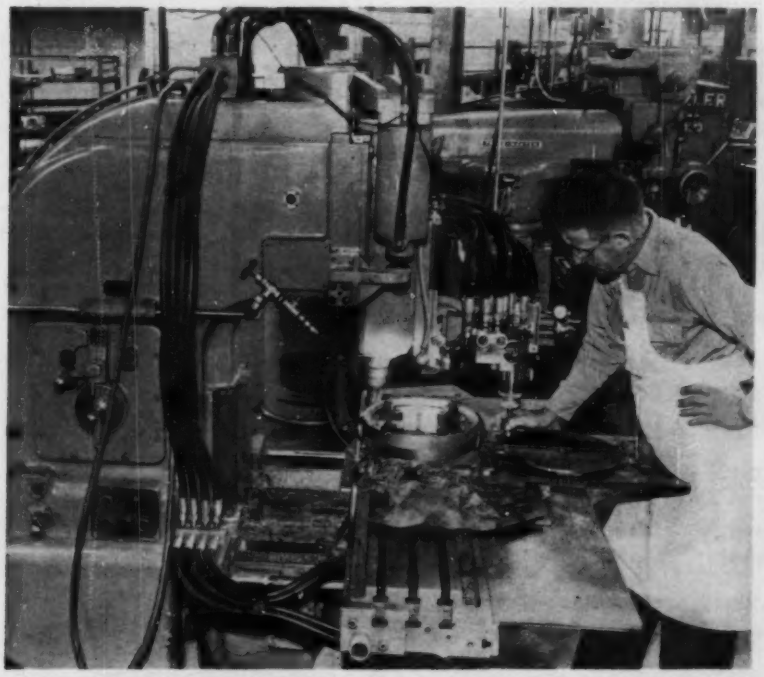
Drilling

Standard HSS drills, suitable for cast-iron work, are modified for molybdenum by producing an extreme hook angle. The drills must be unusually rigid. Air blast keeps the chips blown out of the hole. Drill speed is set by feel, and should be as high as posible. Usually it runs around 150 fpm.

Reaming is also done with HSS tools, with maximum speed around 0.006 ipm. Tapping requires a standard HSS tap, as for cast iron, but with drastic hook angle to prevent seizing.

Milling is best handled with carbide tools. HSS works, but there is a lot of cutter wear, and tool life is short. Side rake should be 0.010-0.012 in., cut depth around 0.008-0.050 in., speed 150 fpm, and coolant air blast. Best technique is to climb mill, which minimizes tangential forces on the cutter. Whenever possible, feed the cutter in from the side rather than from the end to avoid chipping the work.

What little shaping work we've done has been with Carboloy 883 tools at speeds close to those for turning. HSS developed too much heat.



Contour milling setup operates carbide tools at moderate speeds. Note long, thin chips resulting from sharp tool angles

Where to Start Grinding Molybdenum

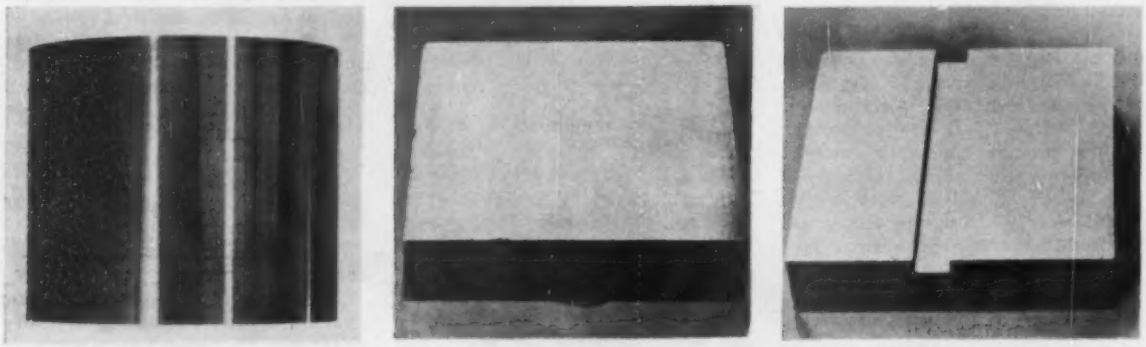
By John A Mueller, manager, testing department,
Technical Branch, Bonded Abrasives Div, The Carborundum Co, Niagara Falls

Molybdenum is fairly easy to grind; it is basically soft, and can be ground on conventional machines with standard feeds and speeds. Unalloyed molybdenum is easier to grind than the alloyed grades, which are sensitive to checking. However, standard, good practices should produce good results.

By all means use a sharply dressed wheel and plenty of coolant. Soluble oil in emulsions of 1:40 to 1:60 are recommended. The wheel should be a soft grade. Table speeds should be fast.

The accompanying table shows a wide range of recommendations that covers most cases generally, and provides starting points for variations.

Overheating from grinding will damage the work, so plenty of coolant should always be applied when possible, particularly on molybdenum alloys.



Ground specimens are roughly 2 in. square—all of 50% molybdenum, 50% tungsten alloy

GRINDING RECOMMENDATIONS FOR ALLOYED MOLYBDENUM

	SURFACE GRINDING		CYLINDRICAL GRINDING				
	SURFACE GRINDING	FORM GRINDING	ROUGHING	FINISHING	BENCH GRINDING	CUTOFF	SNAGGING PORTABLE
WHEEL SPEED—SFPM	5500-6500	5500-6500	5500-6500	5500-6500	6500	10000	9500
TABLE SPEED—FPM	60-80	60-80	5	1	—	—	—
WORK SPEED—SFPM	—	—	70	120	—	—	—
CROSSFEED—INCHES	.030	—	—	—	—	—	—
GRINDING FLUID	Oil Water Emulsion	Oil Water Emulsion	Oil Water Emulsion	Oil Water Emulsion	Dry	Oil Water Emulsion	Dry
INFEED PER PASS—INCHES	.001-.002	.0005	.001	.0005+ spark out	—	—	—
WHEEL DRESSING	Open	Open	Open	Fine	Open	None	None
WHEEL GRADING							
GRAIN	ALUMINUM OXIDE	ALUMINUM OXIDE	SILICON CARBIDE	SILICON CARBIDE	ALUMINUM OXIDE	SILICON CARBIDE	ALUMINUM OXIDE
GRAIN TYPE	Semi Friable	Friable	Friable Green Grit	Friable Green Grit	Tough	Semi Friable	Semi Friable
GRIT SIZE	46-60	100-120	60	80	36	120	203
GRADE	F-G	I	H	R-I	L	P	P
STRUCTURE	Open	Closed	Open	Open	6	Normal	Normal
BOND	Vitrified	Vitrified	Vitrified	Vitrified	Vitrified	Rubber	Resinoid
CARBORUNDUM GRADINGS	DA60-F9-V20	AA100-I5-V40	GC60-H4-VE	GC80-H4-VE	A36-L6-V30	C120-P-RR	C4A203-P-B5

NOTE: For sharper radii, finer grit size will be required.

Chemical milling works molybdenum

By John E Wilson, manager, West Coast Sales & Development, Climax Molybdenum Co, div American Metal Climax Co, Los Angeles

Chemical milling has no undesirable effect on the properties of molybdenum except in certain cases, where it can actually improve the work surface by removing embrittled or contaminated layers. It works as well on molybdenum as on steel, just as easily, and at about the same cost.

The milling rate is from 0.0005 to 0.001 in./minute, with tolerances depending mainly on the surface finish and tolerance of the part before chemical milling. In general, with curved parts of cold-rolled sheet, a tolerance of ±0.002 in. is acceptable. Finishes of 40-60 mu-in. rms are normal.

Any size part can be handled, limited only by the size of available equipment. The largest market at present for chemically-milled molybdenum is in sheet and shapes formed in sheet, where machining would be difficult by conventional methods. Another application is in economically decreasing the thickness of existing sheet, as in reclaiming over-gage stock or in making special thinner sections from standard thicknesses.

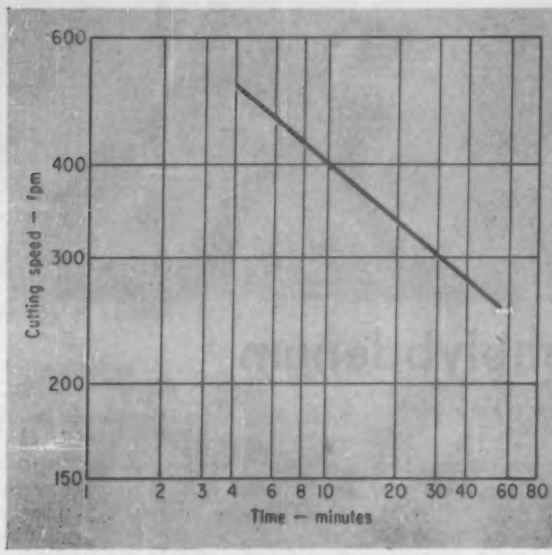
Chemical milling can be applied to any exposed surface and where the work can be immersed partly or fully in the chemical solution, Chemical milling is the simplest method of reducing the wall thickness of forgings and shaped parts; and it allows producing uniform tapers by slowly withdrawing the extrusion or bar from the solution.

Molybdenum poses no special problem with chemical milling; all the natural advantages can be fully utilized.

GRINDING RECOMMENDATONS FOR UNALLOYED MOLYBDENUM

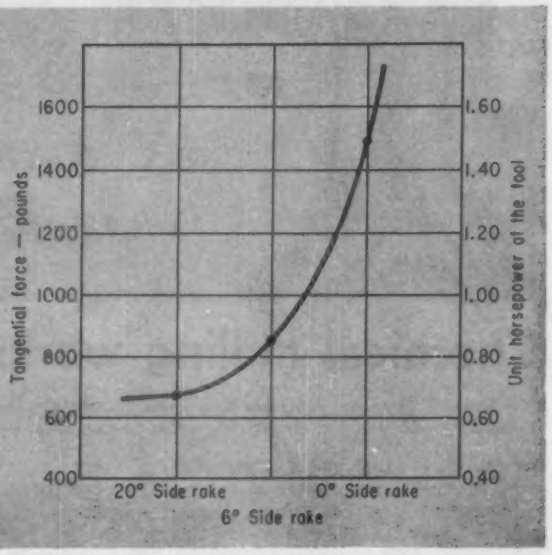
	SURFACE GRINDING			CYLINDRICAL GRINDING				
	PLAIN SURFACING		FORM	ROUGHING	FINISHING	SNAGGING PORTABLE	CUTOFF	BENCH GRINDING
WHEEL SPEED—SFPM	5500-6500		5500-6500	5500-6500	5500-6500	9500	10000	6500
TABLE SPEED—FPM	50		50	1/3*	1/6*	—	—	—
WORK SPEED—SFPM	—		—	70	120	—	—	—
CROSSFEED—INCHES	.032		—	—	—	—	—	—
GRINDING FLUID	Oil Water Emulsion		Dry	Oil Water Emulsion	Oil Water Emulsion	Dry	Oil Water Emulsion	Dry
INFEED PER PASS—INCHES	.002		.001	.001-.002	.001+ Sparkout	—	—	—
WHEEL DRESSING	Open		Open	Open	Fine	None	None	Open
WHEEL GRADING	DRY	WET						
GRAIN	Aluminum Oxide		Aluminum Oxide	Aluminum Oxide	Aluminum Oxide	Aluminum Oxide	Aluminum Oxide	Aluminum Oxide
GRAIN TYPE	Semi Friable	Friable	Friable	Semi Friable	Semi Friable	Semi Friable	Tough	Tough
GRIT SIZE	60	60	100	465	80	203	60	36
GRADE	H	J	I	K	K	R	N	L
STRUCTURE	8	8	5	6	6	Normal	6	6
BOND	Vitrified		Vitrified	Vitrified	Vitrified	Resinoid	Rubber	Vitrified
CARBORUNDUM GRADINGS								
DRY—	AA60-H8-V40		AA100-I5-V40	—	—	TA203-R-B5	—	A36-L6-V30
WET—	GA60-J8-V40		— XX	DA465-K6-V11	DA80-K6-V11	—	A60-N6-RR	—

NOTE: *Width of wheel per revolution of work.
XX For sharper radii, finer grit size may be required.



Tool life vs cutting speed—carbide on molybdenum

Test on arc-cast molybdenum, hardness 180 Bhn, showed sharp drop in tool life as speed increased. Feed was 0.010 ipr, depth was 0.100 in., with tool operated to 0.03-in. wear on cutting-edge flank



Effect of side rake on tool forces

Tangential forces and power requirements rise as side rake is reduced. Test was at 200 sfpm, with 0.010 ipr feed and 0.250-in. depth of cut—no back rake, and 15° side cutting angle

Why molybdenum is a tough metal to machine

By H J Siekmann, manager, Market Development & Research, Metallurgical Products, General Electric Co, Detroit

Average Conditions at Tested Speed Rates

Speed, sfpm	Finish, mu-in. (rms)	Chip thickness (in.) average
25	230	
50	220	0.020
100	155	0.018
200	140	0.0175
300		0.0175
400	135	0.0115
600		0.0085

Finish and chip thicknesses at various speeds, with grade 44A tool, feed at 0.005 ipr, and 0.250-in. depth of cut

Tangential force on tool cutting molybdenum

Side rake (degrees)	Back rake (degrees)	Lead angle (degrees)	Tangent force (pounds)
20	0	15	300
20	0	0	260
6	0	0	780
—5	—5	15	800
20	0	15	660
20	5	15	700
20	—5	45	800
6	0	15	1470
—5	—5	15	1500

Two groups of results from tangential-force test; both made at 200 sfpm, 0.010-ipr feed, but with 0.100-in. depth of cut above dashed line, 0.250-in. depth of cut below

Pure molybdenum costs about as much as pure silver—$12 to $15/pound avoirdupois—and one of the problems in machining this relatively new structural metal is that the chips must be produced in some form that can be remelted—to allow salvage. Actually, it machines something like cast iron—it is soft, but abrasive, and chips are short and crumbly.

Chips contaminated with cutting fluid, oxidation heat, or mixed with trash metals are almost worthless. However, clean chips can be melted directly into the arc-melting furnace—a furnace charge often includes 30% chips—so chip value is high.

Why short tool life?

Past experience in our laboratory with similar metals showed that much tool failure was due to minute chipping of the tool cutting edge, not by the abrasive qualities of the metal. We found this was caused by minute tool-edge build-up, which eventually broke away small portions of the carbide tool edge. In tests we have been able to eliminate this edge build-up by tool geometry. Workpiece abrasiveness has not been a major problem. With proper angles, good tool life has been reached at cutting speeds as high as 600 fpm.

But poor chip flow, along with se-

vere chip oxidation, has also been a problem. This applies to clamped carbide inserts with negative rakes and to brazed carbide tips with zero back rake and 6° positive side rake.

After investigation of a considerable number of alternate tool geometries, we could see that high positive rake produced more efficient chip flow, and reduced tangential cutting forces (vertical component) by 50% or more.

Increasing the side rake proved to reduce the tangential force and the horsepower requirement.

Some 95-98% of machine-tool output is converted into heat at the cutting edge. With high-positive-rake tools, the heat is reduced, less power is required, and chip oxidation is less. With such angles, we did not encounter excessive chip oxidation until we reached cutting speeds of 500 to 600 sfpm, with feeds ranging from 0.005 to 0.010 ipr.

Heat oxidation was also reduced by air-blast cooling on the chip and cutting edge. It was also found most important to keep heavy chips from piling up on the machine bed, because heat was retained in the pile, and oxidation continued. Air blast was also employed to blow the chips out over a wide area.

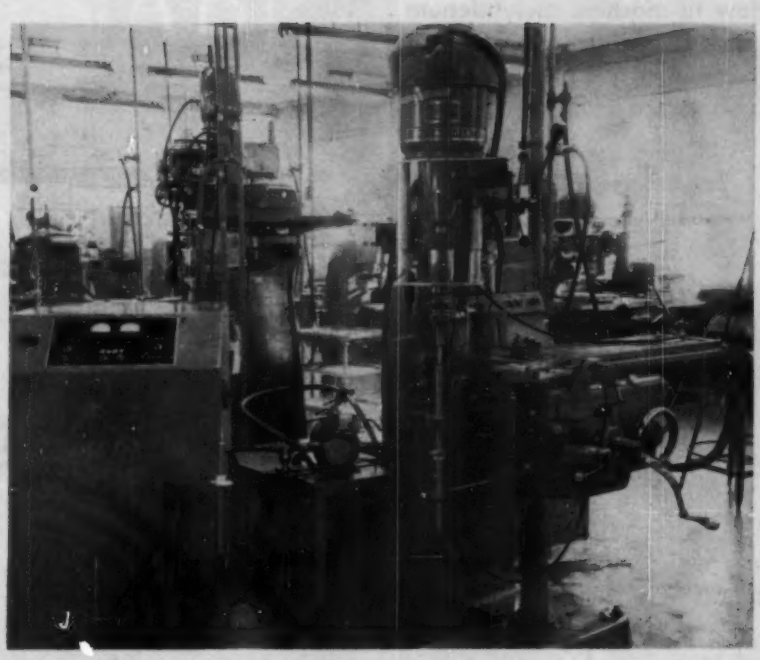
High positive rake angles reduced tool-edge buildup. Although increasing the cutting speed usually reduces edge buildup on non-ferrous metals, and even the hardest steels, no such effect was noticed with molybdenum, even at speeds up to 700 sfpm.

At high cutting speeds the chips tended to separate from the billet in straight sections two to four inches long (no danger to the operator). Mechanical chipbreakers only added to the heat buildup—although they did help chip removal without adding much heat on light cuts. This was probably because of the higher surface area per cubic inch of chip removed, permitting better cooling in the air blast.

Test conclusions

After tests on 20-in. billets, 8 in. in diameter, we found that side rake angles of 20-5° are essential. Lead or side angles should be 15°, but higher angles here offer no particular advantage. Back rake angles at 0° or slightly positive are not critical.

In feed ranges of 0.005-0.010 ipr, a tough grade of straight tungsten carbide/cobalt tool material such as Carboloy 44A was most successful. In lighter finishing operations, a straight tungsten carbide grade such as Carboloy 883 gave best results.



EDM setup was on side of Cincinnati Toolmaster to allow long stroke to full 19.8 in. cut depth. Table was cranked up when spindle downfeed reached limit at 3¾ in.

Electric discharge deep-trepans molybdenum

By Metals Engineering Staff, Picatinny Arsenal, Dover, N J

You can drill and trepan deep holes in molybdenum by electric-discharge machining—if you're patient—with only minor surface sponginess on the work. We did it to produce a molybdenum-alloy temperature probe of unusual contour.

The job was obviously nothing that could be handled by ordinary machining methods—in fact, we were successful only because we had the Elox equipment in the shop and were able to make an experimental setup.

The main problem was the deep separation between the probe itself and the integral shield. To attain reasonable accuracy in this hole we ignored one of the prime advantage of EDM—it will sink a hole of irregular contour straight down into a workpiece—by rotating the work and the tool counter to each other. This balanced any slight runout in the hole, and allowed accuracy within 0.001 in. tir.

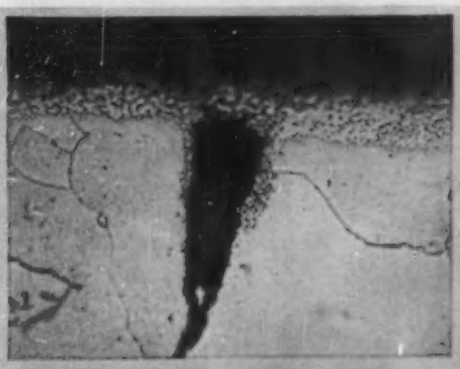
Tooling setup

After the OD of the probe had been machined (dry, with HSS tools), then ground with an aluminum-oxide wheel (Norton 32A60-G12VBEP) and Cimcool), we mounted a baseplate vertically on the edge of the table of a Cincinnati Toolmaster miller. To this we mounted the bedways from an old watchmaker's lathe, then added round bearings to support the work OD.

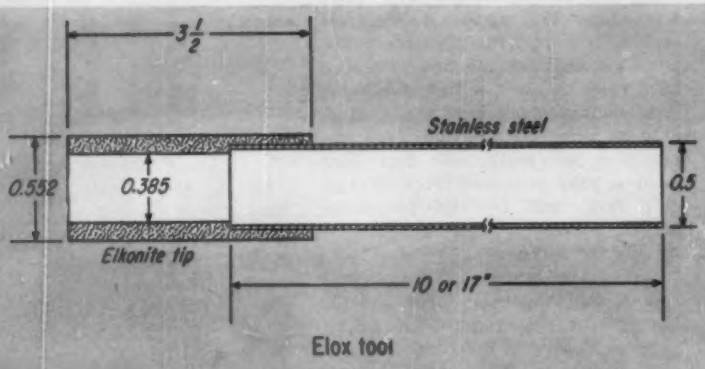
This supported the work vertically, in line with the spindle of the Elox EDM head on the milling machine, and allowed rotation. To spin the work we mounted an old grinding attachment with a vertical shaft some distance away from the miller on the floor, and connected the driving shaft to the driven shaft with a neoprene belt between pulleys.

Rotary speed wasn't important, so we ran the head at its lowest speed —140 rpm—and the grinding attachment at low speed—300 rpm; making it about 440 rpm relative.

One other important point; to make the rig machine as uniformly as possible, we pumped the usual Elox oil down through the head into the work, then let it overflow from a large cup into a collecting tank, from where it ran through a cartridge

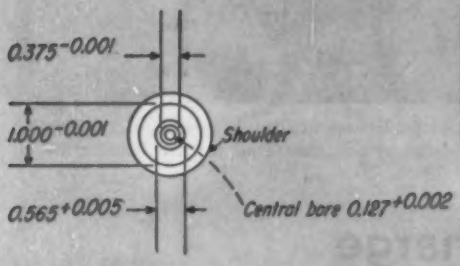


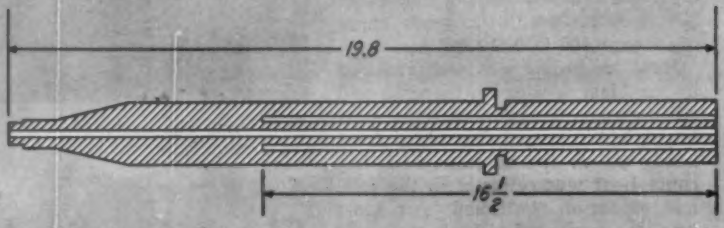
Photomicrograph (500X) shows spongy, amorphous layer 0.0005 in. deep on molybdenum surface after EDM. Deep gash is a pit about 0.005 in. deep. This was ground away on external surfaces



Elox tool

Electrode was stainless-steel tubing with P R Mallory Elkonite tip. Tool OD at 0.552 in. produced work ID at 0.565 in. because of residual erosion; tool ID at 0.385 in. produced core OD at 0.375 in.





Molybdenum probe

Molybdenum probe has central core, integral external shield with trepanned groove 18½ in. deep and small central through hole. Alloy is arc cast 0.5% titanium. Ceramic heat-resistant coating is added later

filter and three settling tanks. This reduced to a minimum the chips and impurities in the oil when it was recirculated. It also allowed fairly high oil flow through the work, both for cooling and to remove particles from the work zone as rapidly as possible.

Machining conditions

Stock brass electrodes were tested, but they wore 6 in. to each 1 in. of peneration into the molybdenum. We tried Elkonite 10W3, a copper-tungsten alloy, brazed to a stainless-steel tube, and wear rate was only 1 in. of electrode per 6-8 in. of work penetration. The electrode tip was spiral-grooved to improve coolant flow in the cut.

Two different tool-shank lengths were required, one at 17 in., and one at 10 in. The 10-in. length started the cut, and the other finished to full depth.

Trepanning speed was about 1 in. of depth per hour. Exact sizes were determined experimentally, because the electrical-discharge method produced a larger hole, and smaller probe OD, than the size of the tool.

Through-hole machining

The central hole, 0.127 in. diameter, was also Eloxed. The tool was a piece of Elkonite 2 in. long and 0.110 in. in diameter silver soldered to a 3/32-in. brass rod. Feed here was also about 1 in. per hour. Holes were cut from both ends of the work, meeting in the middle. This produced an undersize hole that was finished with standard brass rod ⅛ in. in diameter to final size within 0.001 in.

Effect on Molybdenum

As shown in the photomicrograph, the surface of the work produced by electric discharge was spongy to a depth of around 0.0005 in., with pits 0.005 in. deep. This may have been partly due to the fact that no special subsequent cleaning was scheduled. This was ground off where possible.

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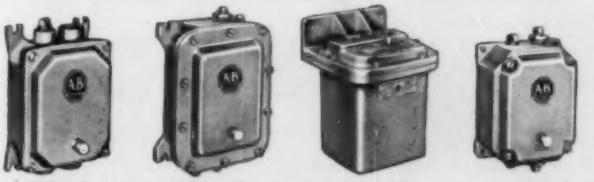

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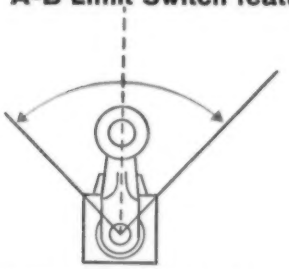

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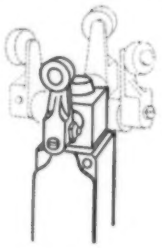

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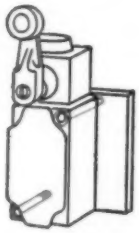

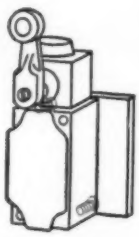

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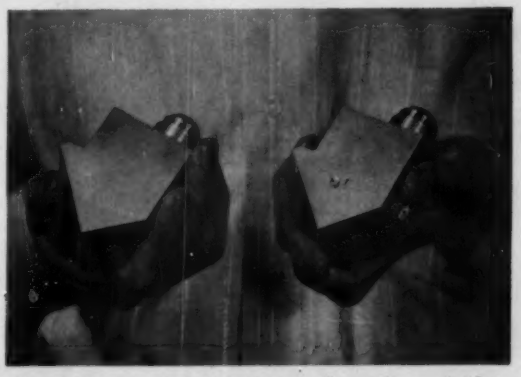

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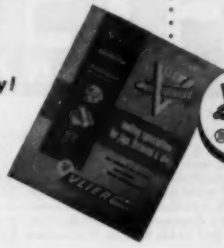

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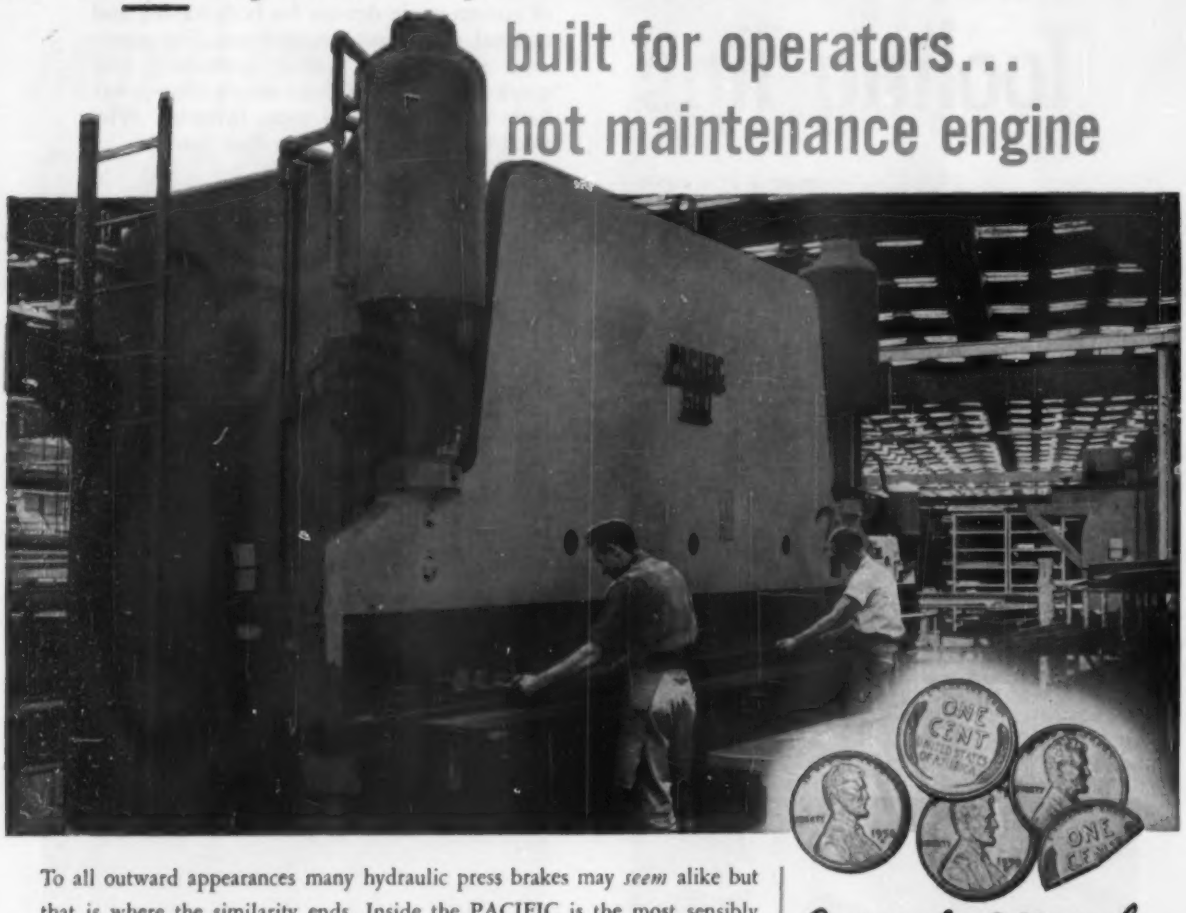

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REFERENCE BOOK SHEET

Control of U-Shaped Bends—I

By Bernard K H Bao, chief tool engineer, Cribben & Sexton Co, Chicago 12, Illinois

Long U-shaped pieces are often troublesome to make when close tolerances are required across the bends. Various corner-setting means are used in die design to compensate for spring back. And usually strip-stock tolerances are required in production.

The method described in this article, in the author's opinion, is the most efficient way to control spring back when the inside bending radius is less than three times the stock thickness. Stock with a close thickness tolerance is not required. Regular sheet-stock tolerance is satisfactory in piece-part production. It is also possible to overbend a piece 2° to 3° when required.

The set corner on the die block is ground with a radius $R + t$ and is stopped at $\frac{1}{2}t$, as shown in Fig. 1. For soft and ¼ hard CRS or aluminum, the punch is made square (without back taper) for a 90° bend. Back taper is allowed on the punch side when overbend is required. Clearance between punch, die and pad is made to maximum stock thickness ($t_{max.}$) In calculating the dimension h, use minimum stock thickness. A nomograph, page 135 simplifies the calculation of h.

A regular rubber stamp, as shown in Fig. 2, may be used to show detailed dimensions of the set corner. Dimensions are filled in after all calculations are made.

Usually it is difficult to hold a close-tolerance bend in one bending operation for a part as shown in Fig. 3. For example, a piece with a large radius (say 8 to 10 times stock thickness) on one side and a smaller bending radius (say less than 3 times stock thickness) on the other side. By using the set corner described, it is possible to bend this part in one operation. The punch face and pad are ground at an angle to compensate for the spring back of the longer leg, Fig. 4. For the shorter leg the punch side is ground with a back taper to over-bend the shorter leg for the amount needed.

Punch radius R' for the longer leg usually is smaller than R on the finished part. It may be calculated* once the angle of spring back is determined by tryout.

*Refer to BAO Stamping Calculator sold by BAO Slide Co, P.O. Box 7902, Chicago 80, Ill.

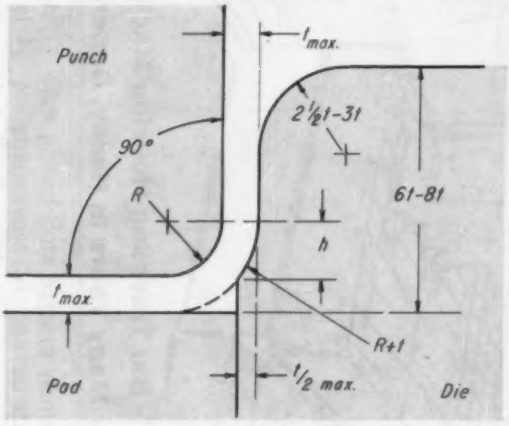

Fig. 1

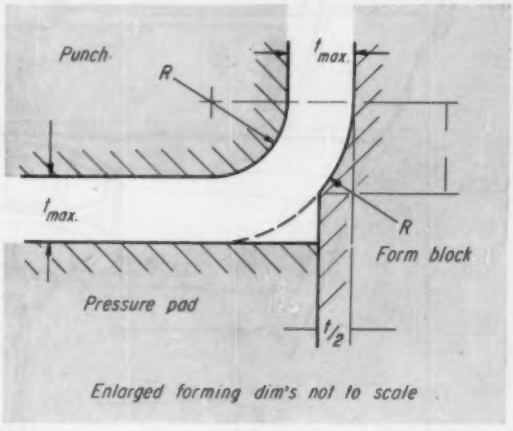

Fig. 2

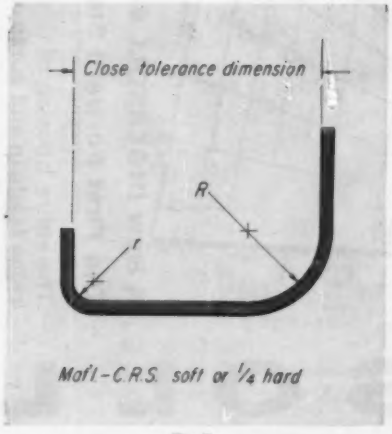

Fig. 3

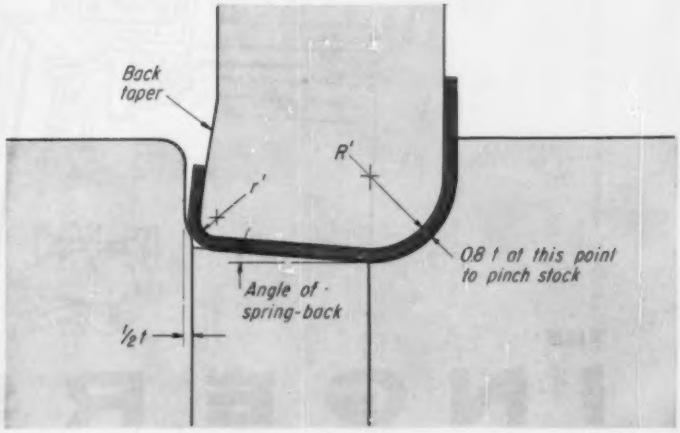

Fig. 4

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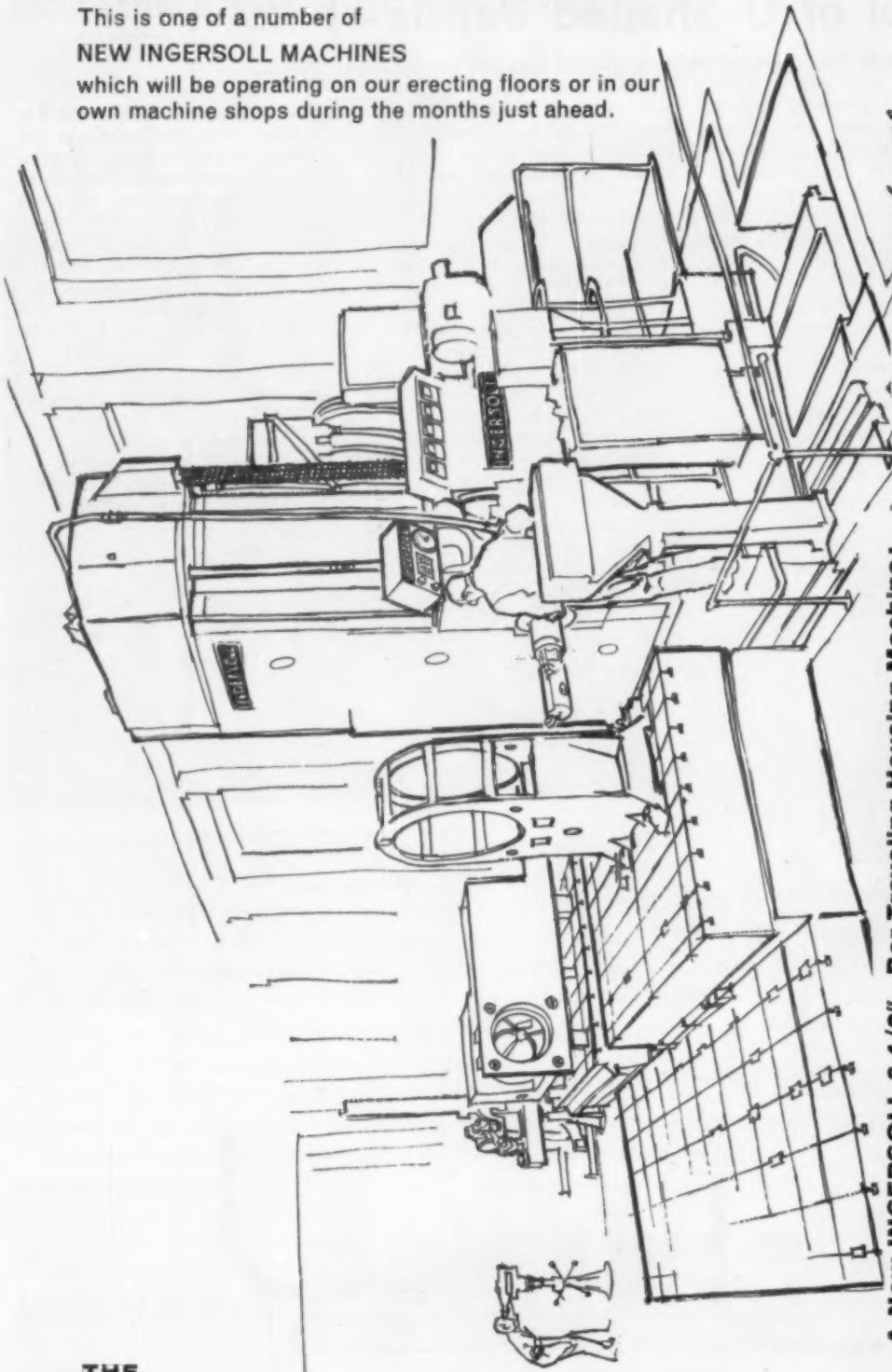

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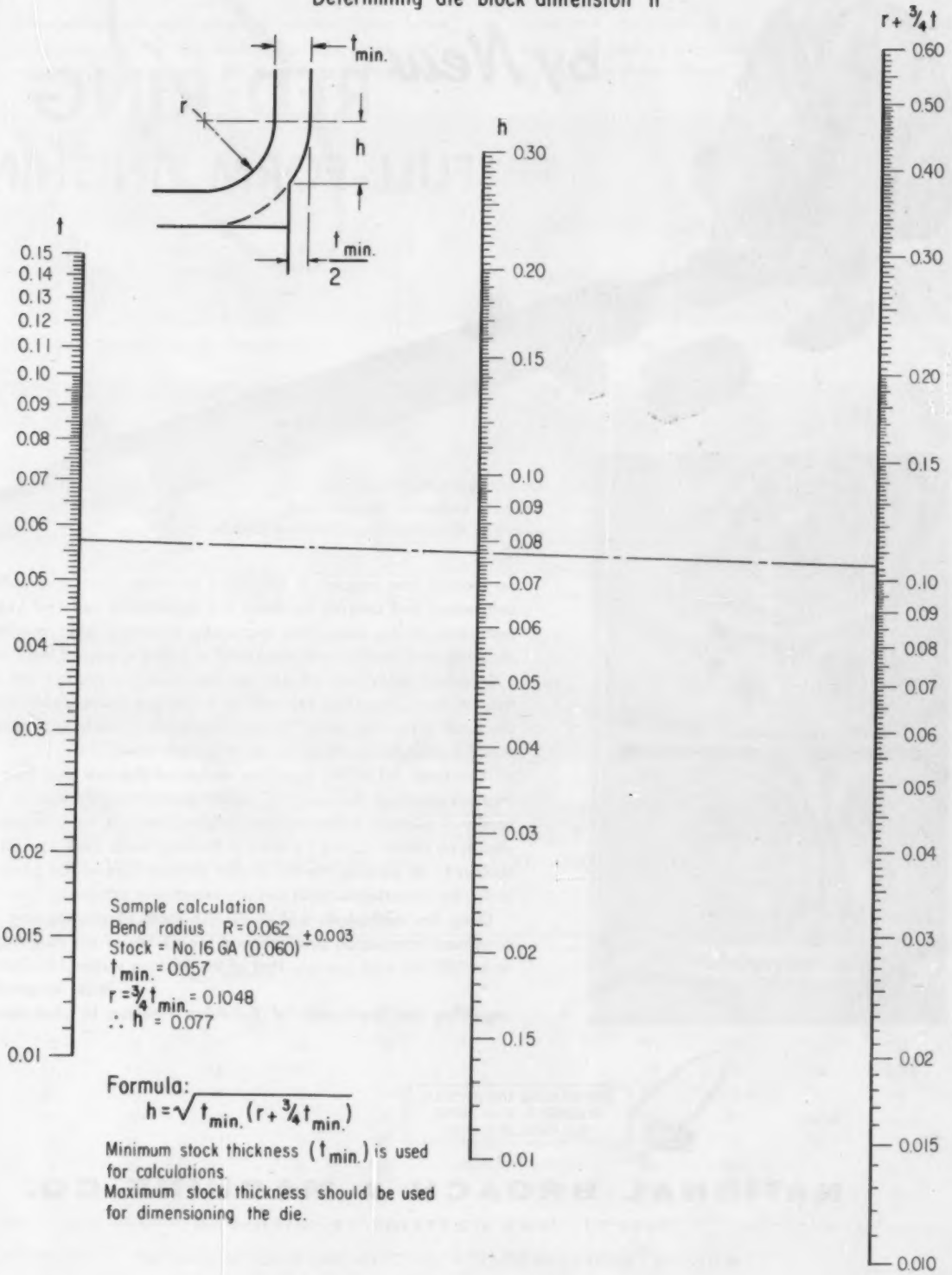
The entire housing of this extremely precise stub boring machine feeds in and out to eliminate bar sag. All movements are measured by precision Ingersoll Read-Out Systems. Split work tables allow loading and inspection while boring. One table is stationary; the other indexes precisely for convenience in boring, as well as for optical inspection of the work before the piece is unclamped. The machine is rugged for heavy cuts and fast moving to the cut. The boring head is temperature-controlled, and the bar is clamped hydraulically to avoid distortion. The machine was designed to do all of our heavy general purpose boring.

THE
INGERSOLL
MILLING MACHINE COMPANY ROCKFORD, ILLINOIS

Control of U-Shaped Bends – II

Determining die block dimension "h"



Sample calculation
Bend radius R = 0.062 ±0.003
Stock = No. 16 GA (0.060)
$t_{min.}$ = 0.057
$r = \frac{3}{4} t_{min.}$ = 0.1048
∴ h = 0.077

Formula:

$$h = \sqrt{t_{min.}(r + \tfrac{3}{4}t_{min.})}$$

Minimum stock thickness ($t_{min.}$) is used for calculations.
Maximum stock thickness should be used for dimensioning the die.

CLOSER TOLERANCE GEARS IN HALF THE TIME

by *New* RED RING FULL-FORM FINISHING

Mounting the shell-type finishing section at the rear end of a Red Ring Full-Form Finishing Broach.

Finishing section

Internal running gear completed in one pass.

An entirely new concept in broaching precision gears and splines for automotive and aircraft industries has significantly reduced production costs and at the same time materially improved gear quality. Both roughing and finishing are completed in a single pass of the tool.

Broached tooth surfaces are not only true to form but are entirely free of the generating tool marks which are unavoidable with conventional broaching tools. Surface smoothness checks out between 5 and 8 microinches in the direction of broach travel.

The secret lies in the ingenious design of this new Red Ring broach (patents pending). The roughing section generates gear teeth in the conventional manner. Following the roughing teeth is an interchangeable shell-type section having 12 rows of finishing teeth. Each row cuts about 0.00025″ of stock on the full profile of each side of the gear teeth—hence the remarkable tooth surface smoothness attained.

Using this method on a 3.5″ PD, 35 tooth internal running gear, a prominent transmission builder found broach life of the roughing section to be 50,000 work pieces—that of the finishing section, 150,000 pieces.

Write for specific data regarding the application of Full-Form Finishing to your operations.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING,
GEAR HONING AND ELLIPTOID

NATIONAL BROACH & MACHINE CO.

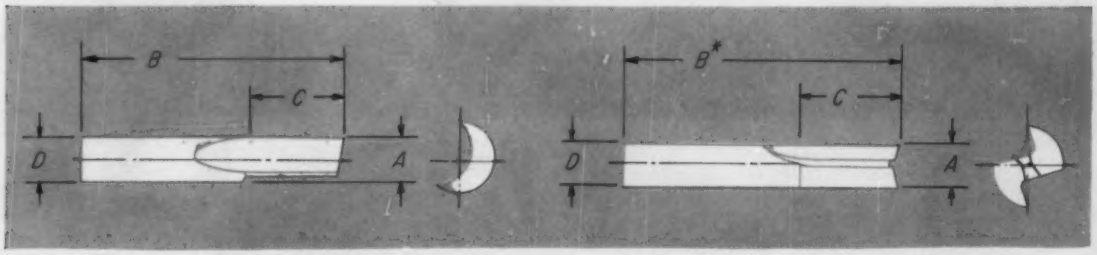
5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

8348

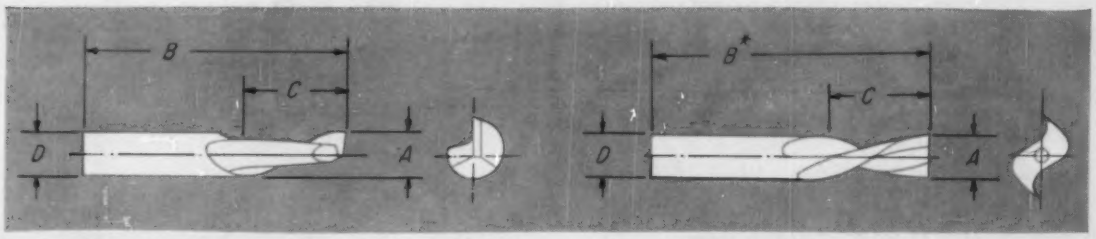
Solid-Carbide Routers

Dimensions of solid-carbide routers have been standardized by the Solid Carbide Tool Institute, 1015 Chestnut St, Philadelphia 7, Pa. These tools are available in six styles, each in seven sizes. All routers are made of grade C 2 carbide by SCTI member firms.



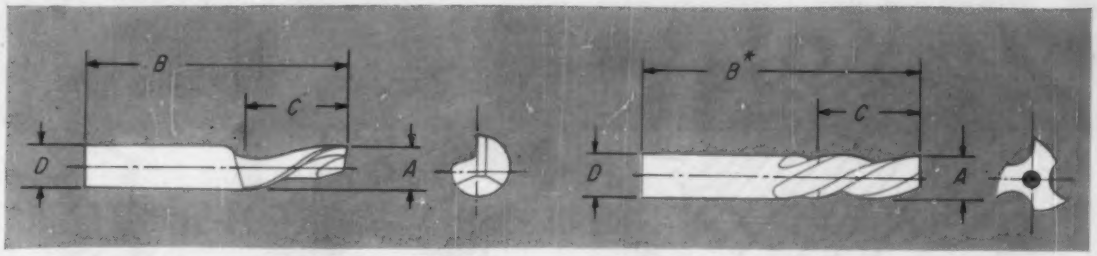
RSS—End Cutting—Single Straight Flute

RDS—End Cutting—Two Straight Flutes



RSR—End Cutting—Single R. H. Spiral Flute (Up-Cut)

RDL—Profiling—Two L. H. Spiral Flutes (Down-Cut)



RSL—End Cutting—Single L. H. Spiral Flute (Down-Cut)

RTL—Profiling—Three L. H. Spiral Flutes (Down-Cut)

Dimensions of Solid-Carbide Routers

SCTI Tool No. (prefix plus number)						Dimensions				
RSS	RSR	RSL	RDS*	RDL*	RTL*	A	B	B*	C	D
12	12	12	12	12	12	1/8	1 1/2	1 1/2	1/2	1/8
14	14	14	14	14	14	3/16	1 7/8	2	5/8	3/16
16	16	16	16	16	16	1/4	2 1/8	2 1/2	3/4	1/4
18	18	18	18	18	18	5/16	2 1/8	2 1/2	13/16	5/16
19	19	19	19	19	19	3/8	2 1/8	2 1/2	7/8	3/8
20	20	20	20	20	20	7/16	2 1/8	2 1/4	1	7/16
21	21	21	21	21	21	1	2 7/8	3	1	1/2

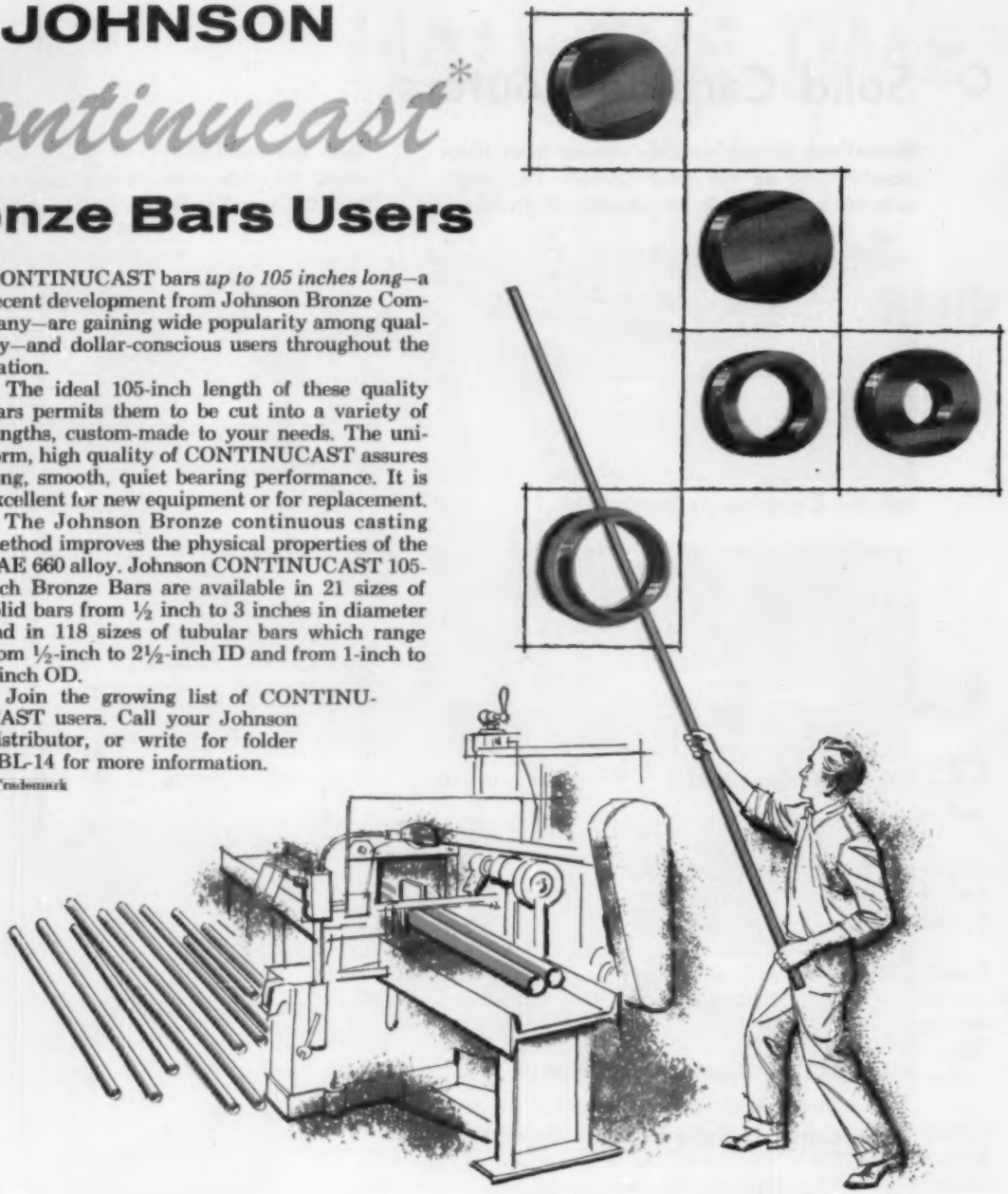
Length B of tools RDS, RDL and RTL is slightly greater as indicated in column marked B

Join the growing list of satisfied

JOHNSON

*Continucast**

Bronze Bars Users



CONTINUCAST bars *up to 105 inches long*—a recent development from Johnson Bronze Company—are gaining wide popularity among quality—and dollar-conscious users throughout the nation.

The ideal 105-inch length of these quality bars permits them to be cut into a variety of lengths, custom-made to your needs. The uniform, high quality of CONTINUCAST assures long, smooth, quiet bearing performance. It is excellent for new equipment or for replacement.

The Johnson Bronze continuous casting method improves the physical properties of the SAE 660 alloy. Johnson CONTINUCAST 105-inch Bronze Bars are available in 21 sizes of solid bars from ½ inch to 3 inches in diameter and in 118 sizes of tubular bars which range from ½-inch to 2½-inch ID and from 1-inch to 3-inch OD.

Join the growing list of CONTINUCAST users. Call your Johnson distributor, or write for folder JBL-14 for more information.

*Trademark

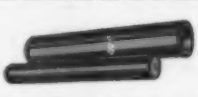
Johnson Bronze Company

New Castle, Pa.

West Coast Plant: Oakland 8, Calif.

GRAPHITED
over 175 sizes

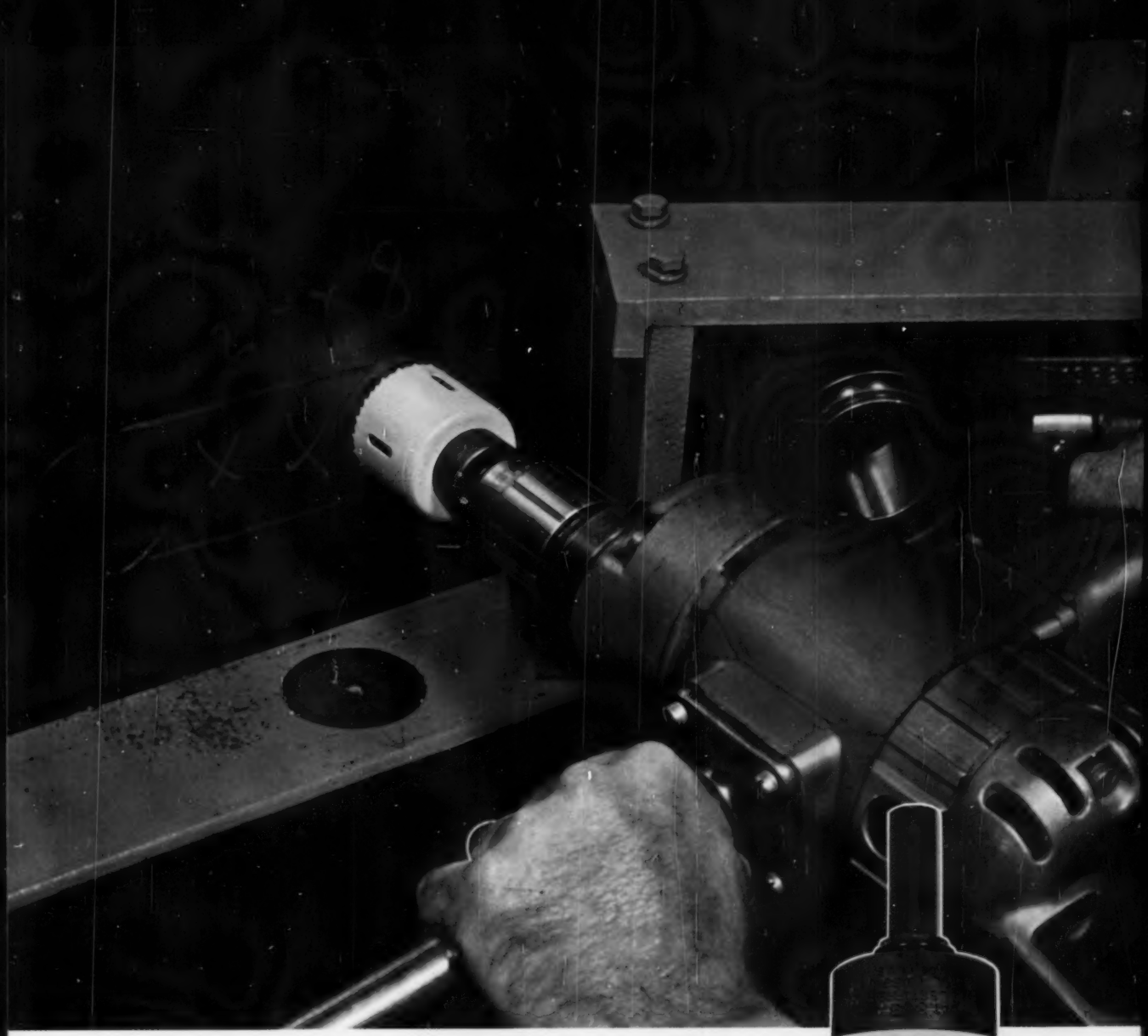
GENERAL PURPOSE
over 900 sizes



UNIVERSAL BRONZE BARS
over 400 sizes

POWDER METALLURGY
over 400 sizes

ELECTRIC MOTOR (EM)
over 350 sizes



Quickest, safest way to cut clean, round holes

STARRETT SAFE-FLEX® HIGH SPEED WELDED EDGE HOLE SAWS

Here's the quickest, easiest and least costly way to cut clean, round holes in any machinable material . . . in steel, brass, bronze, cast iron, aluminum, wood or plastics up to 1⅛" thick. Double welded to combine a high speed steel cutting edge, an extra tough shatterproof body and a rigid steel cap, these completely safe, virtually unbreakable heavy duty hole saws will handle high production cutting or the toughest maintenance jobs.

Starrett SAFE-FLEX High Speed Welded Edge Hole Saws are available in sizes from 9/16" through 6" diameter. Interchangeable arbors accommodate a wide range of saw sizes, come with ¼" pilot drill, 7/16" or ⅜" hexagonal shank or ¼" round shank for use in portable power tools, lathes, drill presses, radial drills and other machine tools.

Your nearby Industrial Supply Distributor has Starrett SAFE-FLEX® Hole Saws in the sizes you need ready for prompt delivery — also Starrett hacksaws, band saws and band knives. Call him for quality products, dependable service . . . or write for Starrett Saw Catalog. Address Dept. C, The L. S. Starrett Company, Athol, Massachusetts, U.S.A.

Starrett®

World's Greatest Toolmakers

HOLE SAWS • HACKSAWS
BAND SAWS • BAND KNIVES

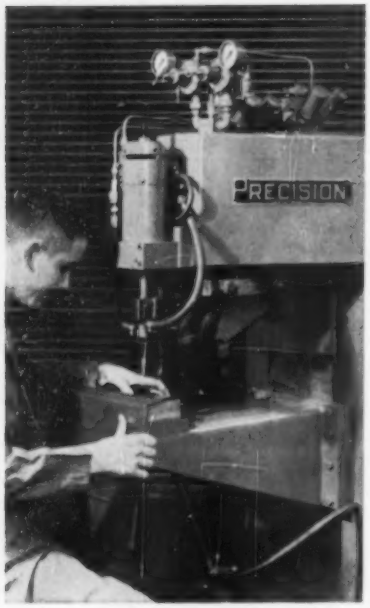
Starrett Precision Makes Good Products Better

PRECISION TOOLS • DIAL INDICATORS • STEEL TAPES • GROUND FLAT STOCK • HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVES

PRECISION® Quarterly NUMBER 5

PRECISION WELDER AND FLEXOPRESS CORPORATION, 3520 Ibsen, Cincinnati 9, Ohio

COAT FIRST WELD LATER



CINCINNATI — Never underestimate the power of a magnet. Because Precision Welder and Flexopress Corp. found a way to put one to work, vinyl coated steel will now fulfill its manifest destiny.

Magnetic force welders, built by Precision, are poised with balanced armatures to open up the whole coated metal market. Now manufacturers can take strip-coated (even painted) steel, form it, and assemble by welding *without marking the coating*.

The organic coatings can be rolled on, sprayed on, brushed on, mill applied; they can be thick or thin, glass hard or rubbery—it really doesn't make any difference, because the secret is in the welding, not the coating.

NEAT HEAT—To weld coated metal, you have to run the welding current in and out of the uncoated side of the metal, and you have to do it with such controlled heating and forging that not enough heat passes to the far side to color or distort the coating. That's quite a trick, which Precision accomplishes with magnetic force welders, like the one in the picture. A good deal of esoteric know-how, hot from Precision's research laboratory, goes with these machines—tips like how big and what shape to make the weld projections, for example.

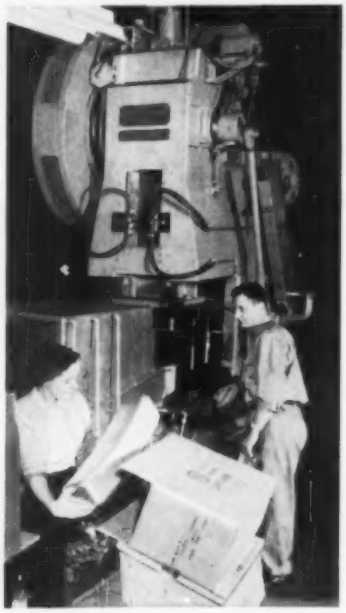
These welds are practical on stock as thin as .015 inch. Size of weld is limited on thin material, but weld strength can equal AWS standards on vinyl coated stock of 20 gage. Ordinarily a matte finish is easier to handle than a high gloss coating, but don't let gloss scare you—in a year or so, you will probably be welding preplated steel.

BRIGHT VINYL WORLD—Available today are Precision vinyl welders for high production jobs, welders, for instance, that can weld a dozen brackets at once to a precoated automobile instrument panel, and never mark the finish. One Precision breakthrough that makes such welders possible is a new gun-type magnetic force welding head. It is cylindrical for compactness, lightness, and effective magnetic attraction.

Because Precision got started down the coated metal road three-four years ago, that car you drive in 1961 will probably have vinyl or acrylic steel-backed trim, held in place by welded-on brackets that you won't guess are there because the welds won't show. And then get set for the deluge: Luggage, business machines, furniture, wall panels, cabinets, lighting fixtures, hardware, appliances, strip-coated first, formed second, welded last. What a lovely sound that money saving makes!

How to Foil Foil

Every tasty pastry has a pieplate all its own—thanks to aluminum foil. And, frankly, thanks to Flexopresses too, like the one in the picture taken at the Reynolds Metals Co. plant in Richmond, Va.



Ninety per cent of all the foil fabrications done in the United States today are done on Precision Flexopresses, made, naturally, by Precision Welder and Flexopress Corp., Cincinnati. That includes pie plates, cake pans, and those ribbed jobs that keep the parts of your TV Dinner from getting acquainted.

Why should Precision be proud of forming foil when everyone knows it's so soft you can crumple it up in your fingers? Because making aluminum foil behave at high speed is about as easy as standing a wet bed sheet on edge. And you have to form foil at around 200 finished parts a minute to make it pay.

That's where the exceptional accuracy and speed of Flexopresses come into play. You'll be eating rolls from a thin aluminum pan tonight because years ago a Flexopress engineer discovered that the way to make a press go fast and stay accurate is to guide the ram with preloaded ball bearing ways—*a Precision exclusive.*

PRECISION

Talking Shop...

Fatal Drop

A MISSILE may fail in its mission because a worker on the assembly line let a part drop one inch on a workbench. This message was delivered this month to the ASME semi-annual meeting by Arthur Bleimeyer, Jr, of ACF Industries.

Tests show that when instruments fall one to three inches, forces up to 20 times those of gravity strike them, and the results are sometimes disastrous. In one plant it was discovered that workers were letting parts drop and that led to the tests in an effort to train personnel to be more careful.

Morning Quiet

THE MOST RESTFUL news at the recent SAE summer meeting in Chicago was that efforts are being made to reduce the noise made by power lawnmowers. Because most of our neighbors favor dawn on Saturday morning as the time to mow, this particular research program of Armour Research Foundation has our hearty endorsement.

By changing the shape of blade in rotary mowers from rectangular to an S shape, by making a dome-shaped engine cover lined with sound-absorbent material, and by modifying the muffler, ARF researchers have come up with a mower that has the same noise level as a conventional rotary mower that is three times as far away. And it doesn't cut the efficiency of the mower, according to William C Sperry, ARF physicist who reported on the development at the recent meeting.

Stable Gage Blocks

A LONG-RANGE program at the National Bureau of Standards is aimed at producing gage blocks that can make measurements accurate to 0.000,000,1 in. per in. (that's one part in ten million). Commercial gage blocks of the highest quality (AA grade) tested by the bureau shrink at an average rate of 0.000,0001,1 in. per in. per year. The best block tested shrank at a rate of 0.000,000,7 in. per in. and the worst block shrank at 0.000,001,9 in. per in.

Sixteen materials are under study by NBS. Blocks made from annealed 410 stainless, nitrided to a depth of 0.009 in., ground to within 0.003 in. of finished length, stress relieved for 3 hr at 975 F in a cracked ammonia atmosphere, and flinshed by lapping have been observed for a year. They have grown 0.000,000,2 in. per in. during the first year.

Another promising block is through-hardened 52100 steel. These blocks were austenitized at 1550 F for 30 min. and quenched in an accelerated quenching oil, stabilized at −140 F for 18 to 24 hr, tempered at 250 F for 1 hr, refrigerated again, and tempered again for 9 hr. After grinding, the blocks were stress relieved at 240 F for 3 hr before final lapping. These blocks have shrunk 0.000,000,4 in. per in. in the first year.

Another promising block is annealed 52100 steel coated on the gaging surfaces with tungsten carbide to a depth of 0.004 in. but more time will have to elapse before the results on these blocks are positively known. All these blocks have been produced by M R Meyerson.

Special measurement techniques have been developed by T R Young and W R Ney. Static comparisons are made with an interferometer and dynamic comparisons are made by a mechanical-electronic technique.

A group of private firms is helping support the research beacuse it is expected that commercial gage blocks to an accuracy of 1 or 2 parts in 10 million will soon be needed in metalworking.

New Market

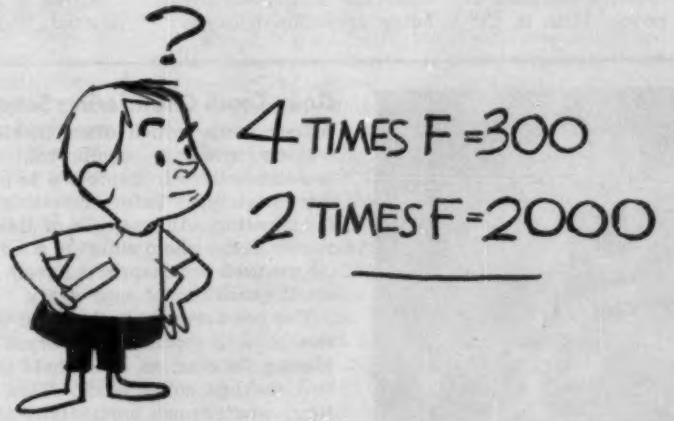
ONE SMALL PRODUCT of metalworking is the familiar tweezers. There's a story going round that a new market has been found for them: To play strip poker in nudist camps.

Pellet Extrusion

EXTRUSIONS made from pellets result in higher compressive yield strengths than obtained from conventional billets. Dow Metal Products is using this method with pellets of ZK60B magnesium-zirconium alloy to extrude the rear loading ramp, floor beams, and other shapes for the Douglas C-133B cargo plane. The plane can carry an Atlas missile. The pellet extrusions have a compressive yield strength of 35,000 psi.

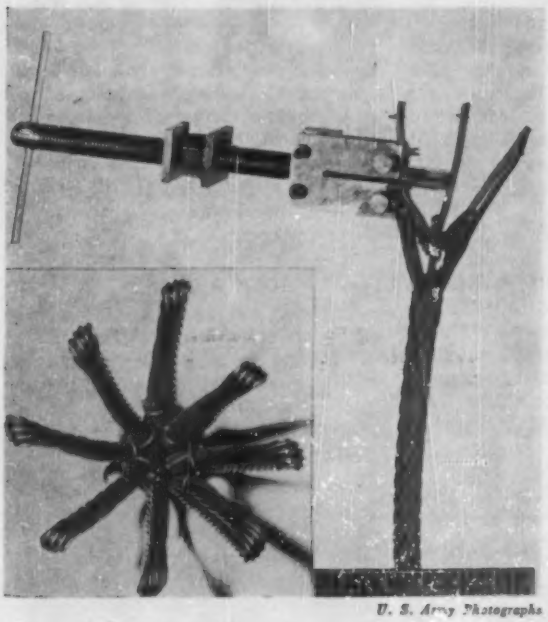
Tap Life

IN TAPPING an assembly screw hole in carburetor float bowl, one GM division was using a standard ¼-20 four-flute tap with a tool life of 200 to 300 holes. By changing to a two-flute tap the tool life has been increased to more than 2000 holes.

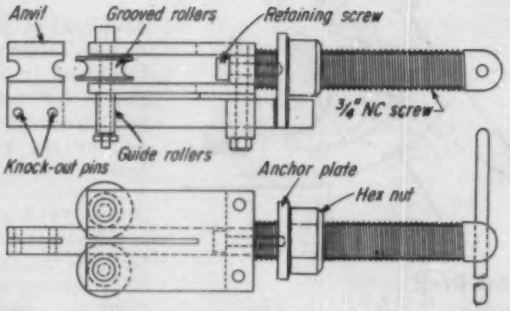


Practical Ideas...

Hand Tool Bends Wire-Rope Strands



U. S. Army Photographs



The American Standard Safety Code for Elevators states in part: "The ends of the strands are bent and turned in and bunched close together, care being taken that the end of each strand is turned back the same distance which should be not less than 2½ times the diameter of the rope." This statement refers to the manner in which a wire rope must be prepared for socketing prior to babbetting.

Without the proper tool, this is not an easy thing to accomplish with any degree of neatness since, as a rule, the bends are made with common pliers. These, at best, are awkward to use and costly for maintenance people who have little or no experience in this type of work.

As we quite often get calls for socketing wire rope, not only for elevators but also for crane installations and repair, I designed and made the strand-bending tool shown. With it, the bending operation becomes routine, all bends come out alike and are held within required tolerances. Lengths and bend radii of all strands are easy to maintain.

The application and operation of the bending tool is illustrated in the photo. An anvil on the end of the tool is hooked onto a strand at a pre-marked location and, as the tool is aimed at the center of the rope, a screw is turned and tightened. This pulls the anvil with the rope strand between two grooved rollers to create a return bend toward the rope's center. After all strands have been bent in the same fashion, (shown in the inset) they are bunched together and deposited in the rope socket. The assembly is now ready for babbetting.

Construction of the bending tool, as shown in the sketch, is kept as simple as possible. Some machining and a little welding just about does it. The slide that moves forward on the rotation of the screw carries the two grooved rollers. It is guided along a bar by a roller on each side and a sliding strap at the screw end. The grooved rollers are interchangeable with others to accommodate strands of different diameters.

The outer end of the guide bar holds the anvil which is secured in a slot with two knock-out pins. And, welded to the opposite end is an anchor plate carrying a ¾-in. NC hex nut to accept the screw. The screw, when inserted in the nut, bears against the back of the slide where it's retained by a small capscrew. Mounting a T-bar through the end of the screw completes the tool.

Alfred S Zanotta, millwright foreman, Watervliet Arsenal, Watervliet, NY

Gear-Tooth Chamfering Setup

In our work, which often involves making research equipment, we sometimes have to improvise to produce prototypes before investing in final tooling. An example of this is shown in the photo which is a method we used for chamfering teeth on small quantities of spur gears.

The gears were mounted in a vertical-milling machine by means of placing them on an arbor held in a tool maker's collet block. This, in turn, was gripped horizontally in a milling vise. The cutter, a rotary file with a suitable taper, was mounted in the spindle and adjusted vertically to contact the edges of adjacent teeth simultaneously.

After positioning the first space to the cutter, indexing the succeeding teeth was made by a spring-tool rest clamped to the machine table. No other means of holding the work was necessary as it seated itself against the rest. Depth of cut was controlled by hand operating the table feed.

H J Gerber, Stillwater, Okla

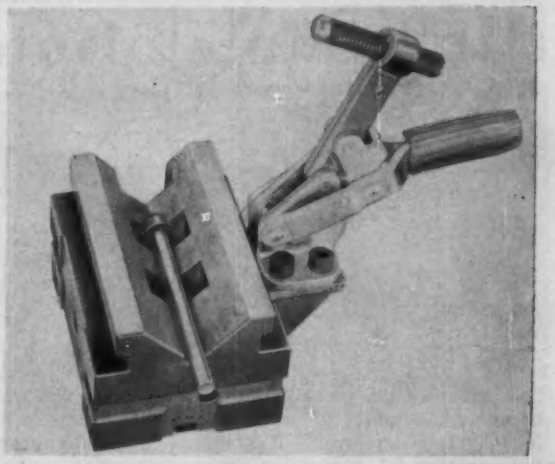
Special V-Block Incorporates Speed Clamping

A need for rapid lockup and release of work prompted the construction of this V-block and the addition of a commercial clamping device. With this tool, cylindrical work — particularly headed parts such as core and ejector pins and parts of similar nature—are speedily set up for grinding or machining to specific lengths, and just as quickly released.

The clamping mechanism alone does away with the task of slipping on a U-clamp which, together with tha work, has to be aligned and steadied while the clamp screw is being tightened. Also, the V-block is so constructed that it will position headed work for repetitive-to-length machining; holding dimensions from either inside the head or to over all lengths.

Built in two sections to provide accurate, rectangular locating holes, the block is keyed, pinned, and screwed together. Two slots, one on each side, is provided to take a regular U-clamp when the block has to be placed, for example, alternately on both sides or when speed clamping isn't necessary.

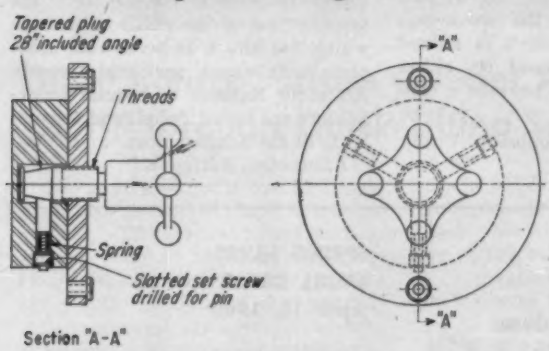
The clamp being shown is a De-Sta-Co clamp mounted on a shelf bracket which is attachable to either side of the V-block. Its pressure point is a threaded rod



which makes the clamp adjustable to hold a wide variety of diameters.

Carl S Frank, Clark, NJ

Fixture Speeds Jig Work



Section "A-A"

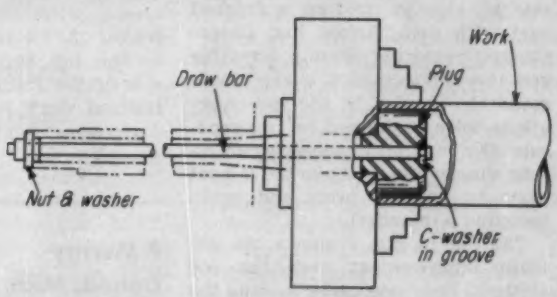
This tool was designed as a locking mechanism for horn-type or templet jigs such as the one illustrated. It can also serve as a self-centering or equalizing locator when drilling holes in rough castings where tolerances on the locating diameter are loose.

Basically, a unit consists of three equally located slip fit and spring loaded pins activated by a tapered plug. The pins are housed in a plug which becomes an integral part of a templet or jig. The tapered plug usually threads into the templet itself. We found a 28° included angle on the plug satisfactory. All pin ends contacting the plug are radiused at a 14° angle.

Spring loading the pins is accomplished by turning them down to accept springs which are retained by setscrews. These setscrews are drilled to a slip fit for the reduced pin diameter and slotted to make assembly and disassembly easy with a screw driver. The plug and pins should be hardened for less wear.

Gene A Norman, tool engineer, Breuer Electric Mfg Co, Chicago, Ill

Plug Supports Tubing in Chuck



This centering plug saves considerable time when quantities of tubing have to be machined in the lathe. Yes, though only a few pieces need turning, it may be the best solution to the familiar problem of gripping thin-wall material in the chuck.

Being integral with the chuck, and machined to fit the minimum diameter of the workpieces, it simplifies loading and assures a firm grip by the chuck jaws. It also prevents permanent disfiguring of the material even when the maximum ID fits loosely on the plug.

The pilot at the back end has a slip fit in the bore of the chuck and the plug is clamped against its face with a draw bar through the spindle. A flanged washer and hex nut provides the clamping force at the spindle end and a C-washer fits a groove in the bar's front end for a means of changing to different-size plugs quickly.

While the chuck jaws are open, the work is slipped over the plug and aligned. If the mounting end of the work is squared off this is easy; the work is merely pressed against the chuck face as the jaws are tightened.

F Murray, Detroit, Mich

Practical Ideas...

Die Produces Thin-Wall Tubes

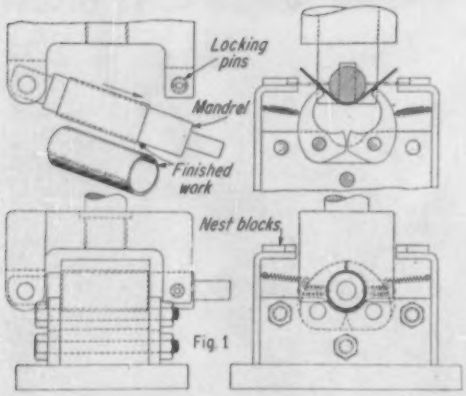


Fig. 1

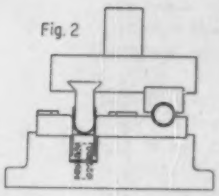


Fig. 2

One stroke of the press and a tube is completed when the die shown in Fig. 1 is employed. This more than doubles the production of conventional tube-curling methods in which two steps and two handlings are required.

Fig. 2 illustrates an updated version of a conventional die showing how both operations are performed at once. Here the steps are placed side by side to produce a finished part with each stroke, but, nevertheless, requiring double handling and the application of a removable mandrel. Previously, the two operations were performed in two separate dies making it necessary to either change dies or move the U-bent parts to another press and again inserting a mandrel.

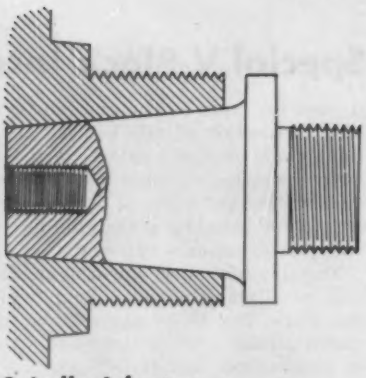
The die in Fig. 1 shows the obvious improvement over the old method. Only one cycle, loading the stock, forming the part, and stripping it from the mandrel, is necessary. The forming principle used here is the same as for the clip-producing die described in AM—Dec 30, '57 p 97.

As the punch comes down, the material is pushed between two hinged jaws in the die. These are activated by the punch the moment it strikes the lower sections of the jaws. They then begin to close, wrapping the material around a mandrel to complete the curling operation. On the up stroke of the press, the mandrel, being an integral part of the punch and hinged in its frame, is swung open allowing the finished tube to slide off. See upper left-hand corner of sketch.

This hinge, or pivot point, is located in the back end of a U-frame which makes up the rest of the punch. The front end is fitted with two spring-loaded locking pins which snap into recesses on both sides of the mandrel. A slight blow with the hand on the projecting mandrel releases it; lifting it up locks it in place.

The forming jaws in the die are hinged in a recess milled to restrict their backward motion. They are kept open during inactivity by two springs attached to the work-nest frame. A locating block is affixed to the top surface and on either side of the frame to provide a centralized work nest.

Hjalmar Dahl, Upplands Vasby, Sweden



Spindle Adapter Takes Special Workholders

This adapter makes the job of mounting work in a large lathe easier when the work is of such length that the larger capacity is needed. When fitted with a small universal chuck or special workholder, the work-mounting process is simplified; the task of manipulating a large awkward chuck is eliminated.

The adapter is machined with a taper to fit the spindle bore and tapped for securing with a draw bolt. The front end is copied from the spindle nose of the small lathe from which the chuck is borrowed; complete with chuck seat and threads. All other fixtures or special workholders are bored, faced, and threaded to fit the adapter nose.

I Solomon, Nutley, NJ

F Murray Detroit, Mich Won $25 for his idea:

SPRING SAVES SMALL DRILLS April 18, 1960

AN EXTRA $25 will be paid for the best Practical Idea in each issue of *American Machinist/Metalworking Manufacturing*. Selection of the winning idea is made by a group of our readers.

PAYMENT—in addition to regular rate for item published—will be made as soon as tabulations are completed. The winner or winners—in case of a tie when duplicate prizes will be awarded—will also be announced in these pages.

JUDGES . . . are a group of *American Machinist/Metalworking Manufacturing* readers who select articles they prefer in a particular issue. This group changes entirely with each issue and represents a true cross-section of our readers. Their decision is accepted by the editors, without reservations or bias, as final in each case.

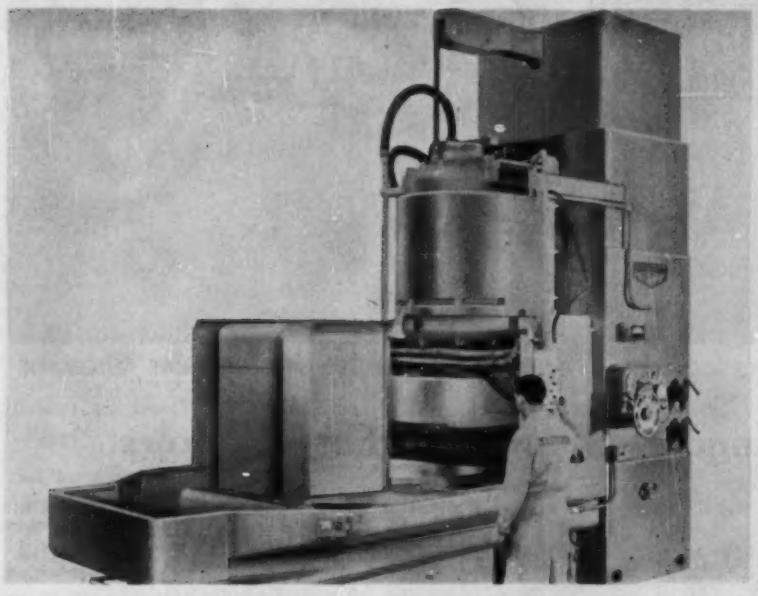
REQUIREMENTS—All items appearing in the Practical Ideas pages are eligible. They must be submitted by the originator on an exclusive basis. Do not worry about your shortcomings as an author, draftsman, or photographer—every item will be edited in accordance with *American Machinist/Metalworking Manufacturing* standards. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of McGraw-Hill Publishing Co. Inc, and those of its advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send all entries to: "Practical Ideas Editor" *American Machinist/Metalworking Manufacturing*, 330 West 42nd Street, New York 36, NY.

New Shop Equipment

Materials and Parts



Giant Rotary Surface Grinder Applies 125 HP through Quick-Tilting Spindle

Extra-large pieceparts can be rough and finish ground in single operation on Quick-Tilt vertical rotary surface grinder with 60 to 72 in. magnetic chuck. Machine has enough mass to apply 125 hp through the spindle, thus increasing productivity by approximately 50% over conventional methods.

Claimed to be unique for this class of machine is the selector-switch actuated power spindle tilting. Pieceparts can be machined with a hogging cut to within a few thousandths of final size—grinding with leading edge of the wheel to increase grain penetration—and finish ground in the same setup.

Downfeed is continuous, from 0.005-0.165 in. per min. It is disengaged instantly, by predetermined stop, when desired size is reached. With continuous downfeed, it is possible to split the last increment of a ratchet-type feed to meet close tolerance limits. There's no feed rate limitation as with cam-and-linkage actuation. Long-range predetermined stops, 0.001-0.240 in., increase efficiency on high stock removal jobs.

New Model 60 features block-type styling and is available with 60-72 in. magnetic chucks. The 72 in. chuck can be furnished with a dead ring to 84 in.

Mattison Machine Works, Rockford, Ill

MORE DATA? Circle 51, inside back cover

US Steel Introduces Lighter, Thinner Tin Plate

New process permits production of tin plate about half the thickness of anything now used in can making. The new tin plate, said to be a completely different product, ranges from 40 to 60 lbs per base box. (A base box is a unit of measure containing 31,360 sq in. or 217.78 sq ft of tin plate.) Most tin plate now used by can producers is in the 75 to 100-lb box range.

United States Steel Corp, 525 William Penn Pl, Pittsburgh 30, Pa

MORE DATA? Circle 52, inside back cover

Helical Path Analyzer Checks Linear, Drunken Thread Deviation

Known as a Helical Path Analyzer, this instrument analyzes both linear and "drunken" deviation from the true helical path of thread plug gages or similar precision threaded parts, such as those used in aircraft instrument and guided missile control and timing devices.

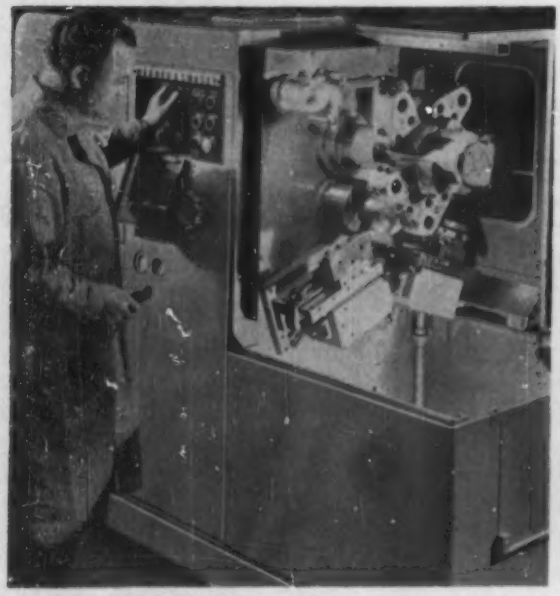
It can check deviations to an accuracy of 0.00003 in. over three revolutions on external precision threads. Results are recorded graphically on a chart recorder and indexing is continuous and automatic.

Analyzer, which actually measures deviations in threads that up to now could not be accurately detected, has a work capacity of 8 in. between precision centers and a 6 in. max diameter. It can check thread lengths up to 5 in., and all pitches and thread forms.

A line on chart recorder graph represents the helical path of a thread for three turns of workpiece. A thread having a theoretically perfect helix appears on graph as a straight line through zero. Lead deviation appears as a straight line veering to either the plus or minus side, depending on direction of deviation. A thread having drunkenness appears as a sine curve repeated over 360°, as the pattern of drunkenness is usually recurrent.

Pratt & Whitney Co Inc, West Hartford 1, Conn

MORE DATA? Circle 53, inside back cover



UNIVERSAL MODEL OF NO. 2 MICROCUT LINE

O-AC MINIATURIZED SINGLE SPINDLE AUTOMATIC

Warner & Swasey Announces Turret Lathes, Chuckers

Five new machine tools, recently unveiled by Warner & Swasey at the dedication of its newly completed Research Center, will be shown at the Machine Tool Exposition in September. Three of the machines feature numerical tape control.

Servofeed turret lathe

A 25-in. swing numerically controlled turret lathe, the Servofeed features an electronic "memory" system designed to store and recall operational commands of any machining setup. This electrically controlled machine can store up to 96 consecutive commands for such machine functions as changing speed, starting rapid traverse, etc. Equally important, any command in memory can be changed at any time without disturbing other machine orders.

Operation of memory system requires no tape or other outside programming. However, an incremental tape path-control system, used exclusively for contouring, supplements the lathe's basic memory control. Since the machine's memory is absolute, the tape contour can be referred at will to an absolute position to maintain accurate relationships. Corrections in the memory system in a horizontal direction of 0.0005 in. and in a cross direction of 0.00025 in. can be made.

From a mechanical design standpoint, the turret lathe is new virtually from the floor up. The entire concept of the machine is said to be predicated on the functional needs of numerical control and on the electrical actuation of all machine elements.

The headstock of the lathe is hydraulically shifted and is powered by a 60/30 hp two-speed motor. There are no handwheels or conventional micrometer dials anywhere on the machine. During setup all machine elements are electrically controlled directly from the console. Slide position dials take the place of regular micrometer dials. Longitudinal dials read 0.200 per rev and are graduated in 0.001 increments. Cross dials read 0.100 per rev and are graduated in 0.001 increments. Each dial can be read to 0.0005 in.

This is still a turret lathe, the maker points out, and as such can make full use of combined cuts for maximum reduction in cycle time.

4-A turret lathe

Cross-sliding turret 4-A lathe, with two axis numerical contour control system applied to both carriage and saddle aprons, can handle complex contouring work up to full dimensional capabilities of the lathe.

Because auxiliary control functions used in contouring are applied by means of standard machine components, through regular feed shaft and full-length screw, the tape system in no way hinders use of machine for conventional turret lathe work.

Electronic system used with lathe is digital and incremental in nature, with input of recorded information supplied by standard 1 in. wide mylar or mylar aluminum laminate punched tape, which can be prepared with a standard Flexowriter.

Machine can contour smoothly either irregularly shaped surfaces or straight line or taper cuts of any any angle. Either carriage or saddle unit may be operated under numerical contour control by a simple switch selection. However, these units can not be operated in this manner simultaneously.

TAC single spinning chucker

Model 1AC single spindle chucking automatic now carries optional numerical tape control system for such operations as speed and feed change, cross slide movements, and length of cut. Entire automatic machining cycle can be preplanned on tape, except for selection of high-low speed range, and installation of feed gears by operator.

Operator can switch from tape programming to machine's standard electro-mechanical control system at any time. The tape system simply functions as an optional addition to standard control arrangement.

Standard 1 in. wide, 8-channeled paper or plastic tape can be used with control system, and all tape handling and control equipment is contained in compact units on the machine. Control operation involves a pure electrical relay system, using well-known telephone type relays. There is no electronic circuitry in the design.

O-AC chucking automatic

A miniaturized, single - spindle chucking automatic, the O-AC brings advantages of automatic production to small lot producers of precision components, such as computer and guidance system hardware. Nominal working range is a 3 in. dia by 3 in. long workpiece. Air chucking is used, featuring a 6 in. dia chuck and a 4½ in. dia tandem air cylinder.

A total of 16 spindle speeds, in four ranges of four speeds each, are provided. Spindle speed selection, plus front and rear cross slide and turret feed selection, are automatic. Speeds range from 87-2507 rpm. Each of the speed ranges has an 11.55 to 1 ratio, with average increment of 2.261 between speeds.

Right and left-hand threading gears are available for solid or releasing type taps or die heads. O-AC is also equipped with automatic reverse for left-hand threading and for backing out solid threading tools.

Machine is powered by a standard 5 hp main drive motor.

No. 2 microcut machine

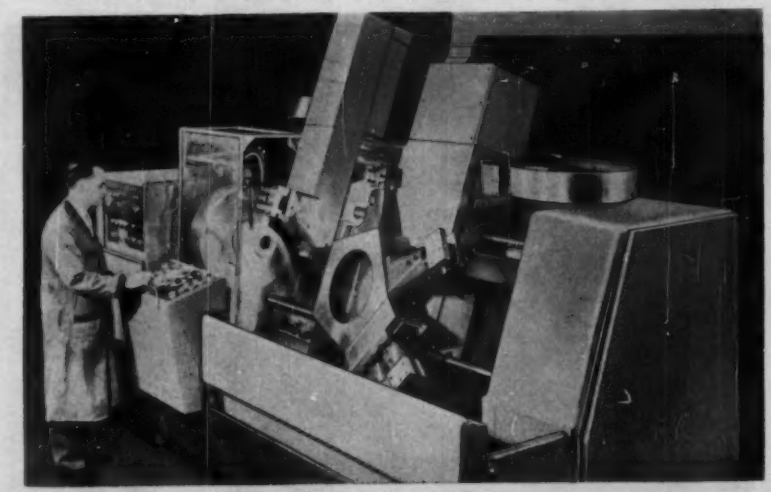
Designed to handle highly critical machining of small-to-medium sized precision parts, the No. 2 Micro-Cut turret lathe is also suited to machining jobs involving miniature components of all kinds.

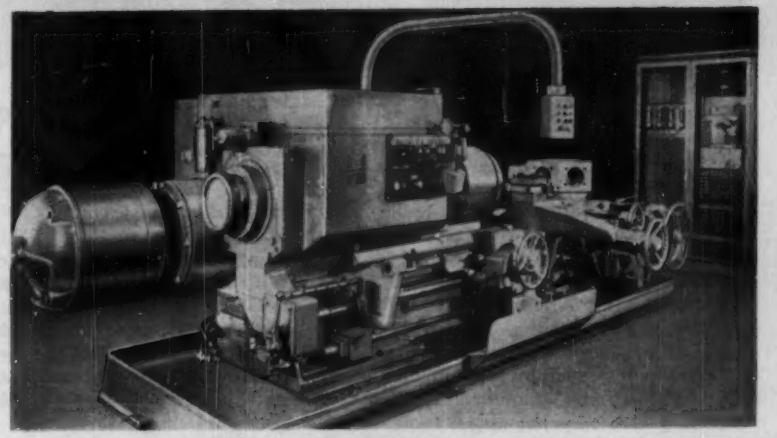
Machine swings 14 in. over bed and 6 in. over cross slide. The spindle is a 5 in. American standard flanged nose type A-1. Three interchangeable transmission output sheaves provide three ranges of six speeds each: 100-3000, 70-2100, and 50-1500 rpm. Motor is a two-speed 5/2½ hp unit, while transmission is of 3-speed, magnetic clutch design.

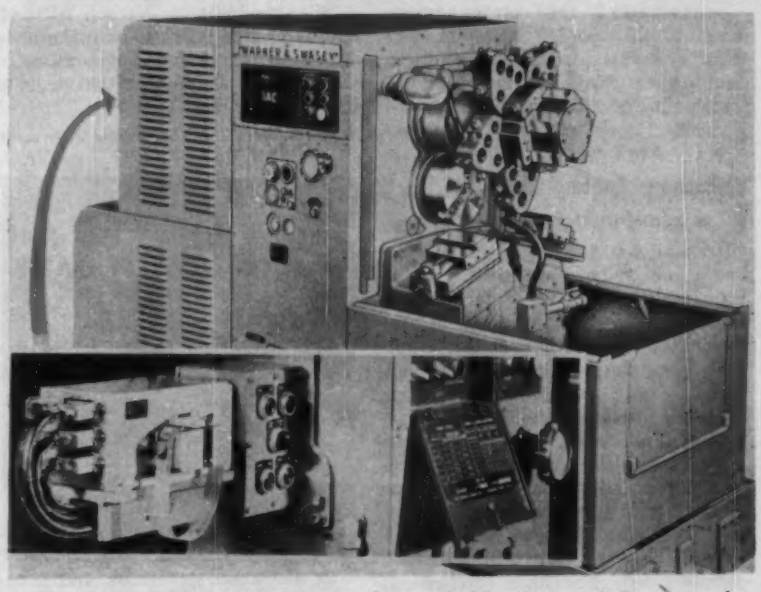
No. 2 Micro-Cut lathe is being made available in three different model configurations: Plain turret lathe with conventional hex turret, universal turret lathe featuring a full universal cross slide and square turret, and precision chucking turret lathe with flat-type 8-station cross-sliding turret exclusively.

Warner & Swasey Co, 5701 Carnegie Ave, Cleveland 3, Ohio

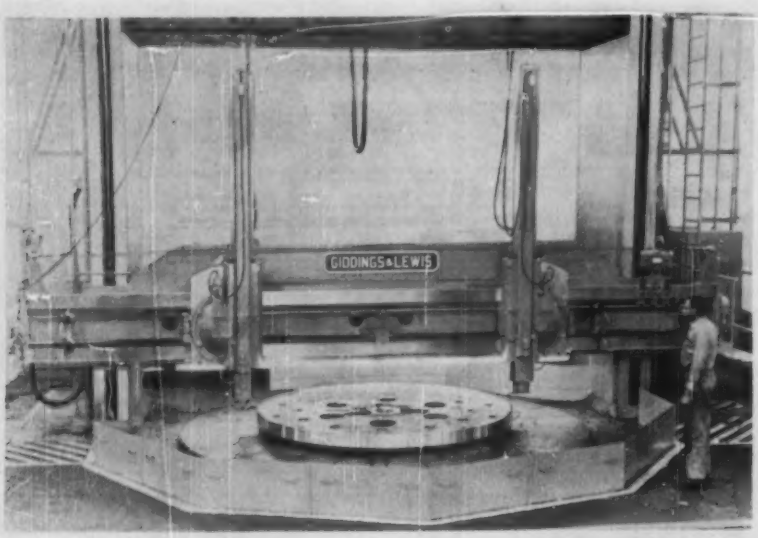
MORE DATA? Circle 54, inside back cover







TAPE CONTROLLED MACHINES recently unveiled by Warner & Swasey and to be shown at Machine Tool Exposition are, top to bottom, 25 in. swing numerically-controlled Servofeed turret lathe, 4-A turret lathe with Servo-Tape numerical contour control attachment for carriage and saddle aprons, 1AC single spindle chucking automatic with tape control system.



Vertical Boring Mill with 20-ft Swing Has 16-ft Table Mounted over 12-ft Table

New 100 hp vertical boring mill with 20-ft swing is equipped with a 12-ft diameter table over which is fitted a 16-ft table for machining large workpieces. Larger table can be removed so that smaller work can be handled on the 12-ft one. This makes it easier for operator to get at smaller workpieces, and permits higher machining speeds than would be practical with only the larger table.

Loads up to 75 tons can be accommodated with ample safety factor. Vertical thrust load is carried by a double anti-friction bearing table track and a double preloaded tapered bearing at center of the table.

Table drive speed range is 0.26-22.5 rpm. Shifting is accomplished by hydraulic pressure controlled electrically from pendant station. Infinitely variable table speeds in a ratio of 21.8 to 1 are provided in each of two speed ranges. Constant horsepower is available to table over a 3 to 1 range. Constant torque is available through the complete 21.8 to 1 motor speed range.

Mill was built for Verson Allsteel Press Co, who will use it in the machining of large press assemblies.

Giddings & Lewis Machine Tool Co, Fond du Lac, Wis

MORE DATA? Circle 55, inside back cover

Ultrasonic Tooling Machine Dices Semiconductor Materials

Ultrasonic tool for precise machining operations in hard and brittle materials, including dicing of germanium and silicon wafers and other semiconductor materials, is suitable for low production requirements and also has built-in capacity to handle high production needs.

For low production, transducer and workstation are mounted horizontally (as illustrated)in less than 9 by 36 in. of space. Workpiece is fed into tool oscillating 20,000 times a second. Tools up to two in. diameter can be used. For high production, transducer is mounted vertically and an attachable adapter provides eight workstations which can be operated simultaneously or independently.

Machine is powered with 1000

watt electronic generator, and is capable of machining as many as 300 dice (0.030 x 0.010 thick) in a 1 in. dia wafer in less than 45 sec.

The Sheffield Corp, Dayton 1, Ohio

MORE DATA? Circle 56, inside back cover

Kenhos Small Transfer Machine Allows Work on All Six Sides

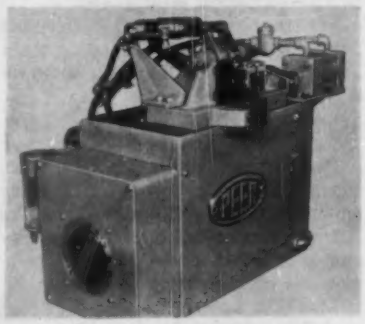
Small transfer machine, with up to 40 tooling stations, can provide for drilling, tapping, milling, boring, wet grinding, and polishing. Machine features modular building block base sections of 4 and 5 ft lengths which are equipped with T slots at top and bottom. This allows both bench and floor type power head units to be installed at any desired location. Machine is available in both rectangular and round models.

Pallets of the machine hold compass direction all around the four sides, and are designed to permit underneath operations as well as any from top and all sides. Standard machine has coolant troughs and chip removal space on either side of the row of pallets for broad general machining as well as assembly service. Pallets hold tolerances under 0.001 in.

Drive mechanism is a hydraulic package unit which includes large tank and a built-in water cooling heat exchanger for full oil temperature control.

Kenhos Corp, Darien, Conn

MORE DATA? Circle 57, inside back cover



High-Production Butt Welder Has Built-in Actuator

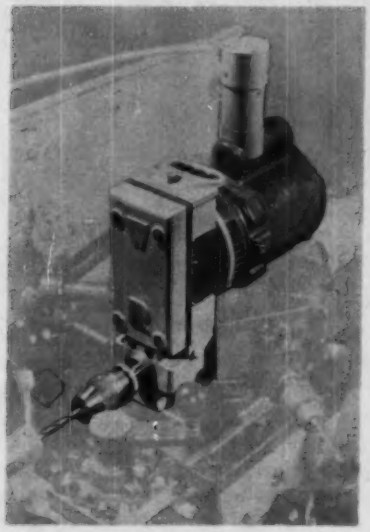
Model B10 automatic air-operated heavy-duty unit holds pre-set alignments. Clamping jaws are actuated by individual air cylinders to assume positive clamping action at all times. Upset pressure is also air operated by a third independent air cylinder with complete control of both the upsetting pressure and degree of upset. Motion of the movable jaw is straight-in-line and not through an arc as with many butt welders.

Built-in non-critical automatic welding actuator eliminates air pressure switches used on previous machines. It is only necessary to set the jaw clamps for the thickness of material being welded, set the current

control switch for degree of heat required and start welding. Individual setting of the clamping pressure and upsetting pressure can also be made, as well as an adjustment for degree of upset required. Standard equipment includes two air pressure regulators with individual gages and airline oilers, airline filter, and one set of clamping jaws and welding dies. Factory price is $1195.

Peer Inc, 1200 Milton St, Benton Harbor, Mich

MORE DATA? Circle 58, inside back cover



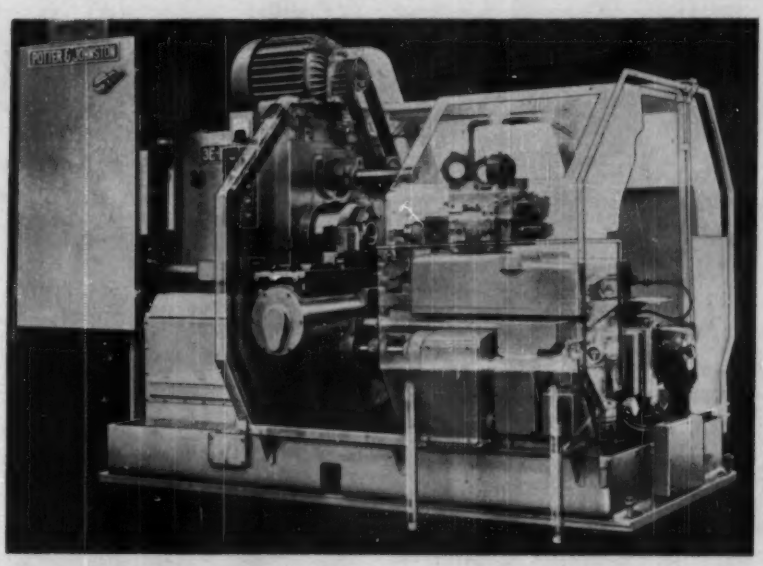
Drill Speeder for Turret Lathes Has Speeds Up to 1615 rpm

Model 3-201 provides accurate, high-speed drilling for both ram and saddle-type machines. Capacity for tool steel is ½ in. drill, No. 2 Morse taper. Unit has four speeds; two different combinations are optional—either 340, 510, 625 and 945 rpm, or 530, 865, 1045, and 1615 rpm.

Rear of the body casting mounts directly to the turret face and mounting is rigid enough to insure accuracy at all times, even under heavy shock of rapid indexing. Additional advantage is short overhang; it takes up only 4½ in. from face or turret to end of spindle, leaving most of the working space free and accessible. Swivel electrical connector permits the gun driller to rotate freely with the turret without tangling the lines. Unit which uses a ¾-hp 3-phase 220/440-v motor fits the W&S No. 3, 3EC, 4, and 16-in. EC; Gisholt No. 3 and 4; and J&L No. 3 and 4 with adapter.

Ward-Riddle Co, 241 Myrtle St, Ravenna, Ohio

MORE DATA? Circle 59, inside back cover



P&J Automatic Turret Lathe Has Optional System for Electric Punched Tape Control

Designed for fast metal removal of the toughest super alloys, with excellent finish and high accuracy, this 15 hp automatic turret lathe incorporates a rigid steel weldment base, with hardened and precision ground ways. Standard on this Potter & Johnston 3E-15 is the six face turret, allowing more cuts per cycle.

Available as optional equipment is the P&J Tape Control. An electric, not electronic, system, it requires no tubes or transistors. It can be added to current P&J models now in the field. All motions of the spindle, turret, and cross-slides, including all speed and feed changes, are automatically controlled by a punched tape. As much as 25% savings in time has been reported by users.

Lubrication system has been centralized for easier maintenance.

Lathe has selector switch cross slide control panel that allows setting of all cross slide movements by means of a selector switch for each slide. There are four automatic speed changes for each set of speed change gears (standard is 60-1540 rpm) and six feed changes for each set of feed change gears. Feed range per spindle revolution is 0.002-0.162 in. An extra large control drum has been designed for easy accessibility for set-up. It controls all machine motions, stop, start, rapid traverse, and speed and feed changes.

Pratt & Whitney Co Inc, West Hartford 1, Conn

MORE DATA? Circle 60, inside back cover

Linde Shape Cutting Machines Incorporate New Drive System

Oxweld CM-56 dual-carriage machine, available in three models, features a new drive principle. Known as roller drive, design completely removes the drive wheel from the templet table. In ordinary cutting machines the drive wheel is on the tracing table surface riding on the templet. With the CM-56 it is not necessary to provide protection for the templet to prevent scuffing or damage to the outline to be traced. There is no force tending to shift position of the line drawing and it is easier to move and align the templet. Drawings can be positioned without raising the tracing head.

Main rail carriage running on the main rails carries another pair of rails supporting the transverse carriage. With combined motion of the two carriages it is possible to follow and cut metal parts and forms of any shape. Either carriage can be locked making it possible to produce perfectly straight and accurate cuts parallel to the main rails or at exactly 90° to them. The 10-ft model carries up to 8 torches; the 7½-ft model up to 6; and the 5-ft model up to 4.

Linde Co, Div of Union Carbide Corp, 270 Park Ave, New York 17, NY

MORE DATA? Circle 61, inside back cover

Screen Separator Has Variable Speed, Adjustable Slide Angle

Model SS-4L gives separation of processed parts and tumbling over a broad work range. Variable speed drive permits adjustment from 145-350 reciprocations per minute, with screen movement variable 0-1½ in. Machine is completely self-contained, motor driven, and has controlled feed with 3-7° adjustable slide angle. Interchangeable square mesh screens, 31 x 60 in., are used.

Other features include front loading and front discharge, ¾ hp 220/440 three-phase motor, simple hand-wheel speed control, and heavy duty construction. Model is 10½ ft long x 43 in. wide; height to top of cradle is 44 in. above floor.

John F Rampe, Rampe Mfg Co, 14915 Woodworth Ave, Cleveland 10, Ohio

MORE DATA? Circle 71, inside back cover

Canadian Vertical Mill Has 18 Feeds, 12 Speeds

Rapidmil No. 2, made in Canada, is constructed with a rugged column and head casting and fully proportioned knee. Eighteen feeds and rapid traverses are provided in all directions. The traverses are mechanical (direct drive from the column) and are engaged by simply lifting the clutch handle.

The miller has 5-hp main motor, 12 spindle speeds up to 1500 rpm, and weighs 4036 lbs. Vertical head swivels 45° to left and right and spindle quill travel is 3¼ in.

B. Elliott Ltd., Port Hope, Ontario

MORE DATA? Circle 72, inside back cover

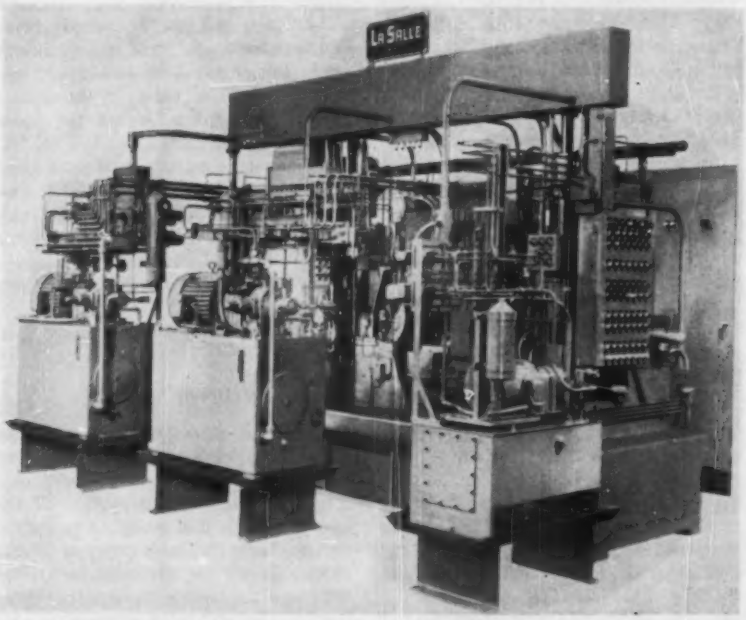
DoAll Offers Line of Four Variable Volume Hydraulic Pumps

Line of four variable-volume hydraulic pumps use the movable-camring principle for automatically adjusting volume to demand while maintaining constant pressure. Models 6-500R and 6-500L are 500-psi, 7-gpm pumps. Models 6-1000L and 6-1000R are 1000-psi, 6.5-gpm pumps.

According to the manufacturer, variable volume-pumps are used in hydraulic systems to provide efficiency under varying operating conditions.

DoAll Co, Des Plaines, Ill

MORE DATA? Circle 73, inside back cover



PISTONETTE 8-STATION TRANSFER MACHINE requires only 70 square feet of floor space. In 14 feet this machine combines automatic handling of machining and gaging to produce 6 operations on pistons for 6-cylinder Valiant. It rough bores and chamfers wrist pin hole; gages wrist pin hole; drills 2 oil holes, angularly, through wrist pin boss; mills weight pads to length; saws 2 smoke slots in piston ring groove; gages for existence of 2 oil holes; and has automatic blow-off. It handles 600 pistons per hour—*LaSalle Machine Tool, Inc, 380 E Outer Dr, Detroit 34, Mich*

MORE DATA? Circle 104, inside back cover

Small Horizontal Grinders Introduced by Buckeye

The 31G-520 (shown) and 31G-720 are 10 in. long and weigh 40 oz. Both operate at 20,000 rpm, require 1/4-in.-ID hose and 90-100 psi pressure, have 1-5/16-in.-OD front heads and will take a maximum 1-3/4-in. organic wheel. Difference is in the throttle; the 520 has a lever type, the 720 a lockbutton. Principal application of these air tools is die

grinding, but they are suited for deep hole grinding and may be adapted for use with rotary files, cutters, and midget mills.

Design features include all steel housing including a steel front head for additional strength and resistance; shielded bearings; and rotatable baffle ring and a muffler. Any one of the following accessories is available at no extra cost: 1/8, 3/16, or 1/4 in. long or short collets; 3/8 or 1/2 in. short collets; 1/8, 1/4, or 3/8 in. extension spindles; and a 5/8-in.-11 spindle adapter. Price is $135.

Buckeye Tools Corp, 5003 Springboro Pike, Dayton 1, Ohio

MORE DATA? Circle 74, inside back cover

Pneumatic Stretcher Simplifies Strapping of Awkward Shapes

Heavy-duty Model 651 handles ¾ and 1¼-in. strap in 0.035 and 0.050-in. gages. Adjustment for use with different gage strap is made by screwdriver setting. Air-driven tool can be fed directly from coiled or reeled strap, eliminating need to precut. Take-up of strap to predetermined tension is controlled by lever; when set tension is reached, tool automatically cuts off. Unit operates within air pressure range of 35 to 120 psi.

A J Gerrard & Co, 400 E Touhy Ave, Des Plaines, Ill

MORE DATA? Circle 75, inside back cover

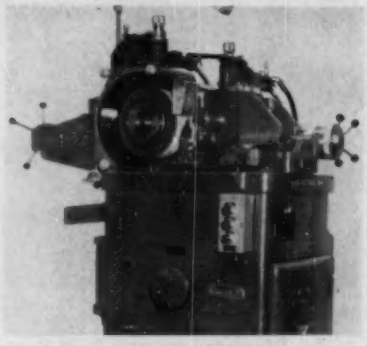
Screwdriver-Nutrunner Line Added to Buckeye Air Tools

Four basic models of 90° angle-head reversible screwdrivers and nutrunners are available, 1750, 1000, 700, and 500 rpm, with choice of two throttle types (lever and lock button) and three different spindles (¼ and ⅜ in. square and ¼ in. female hexagonal).

Rated capacity of all models is ¼ in.; weight is balanced from 2⅛ to 2¼ lb; head length is a max of 11⅝ in.; price is $185; 90-100 psi working air pressure and ¼ in. ID hose are recommended.

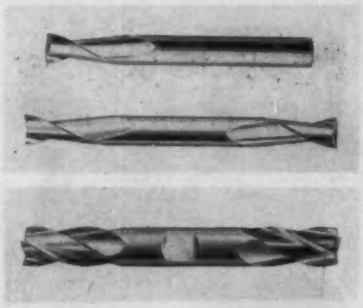
Buckeye Tools Corp, 5003 Springboro Pike, Dayton 1, Ohio

MORE DATA? Circle 76, inside back cover



CENTERLESS GRINDER, with permanently mounted crush dresser, is designed for thrufeed, plunge feed and infeed. It can grind materials from plastic to carbide to 0.0002 in. or 6 to 8 microinch finish—*Royal Master Grinders, Inc, 272 Hwy 23, Riverdale, NJ*

MORE DATA? Circle 77, inside back cover



Brown & Sharpe Enlarges Line Of Thriftmills With 3 Tools

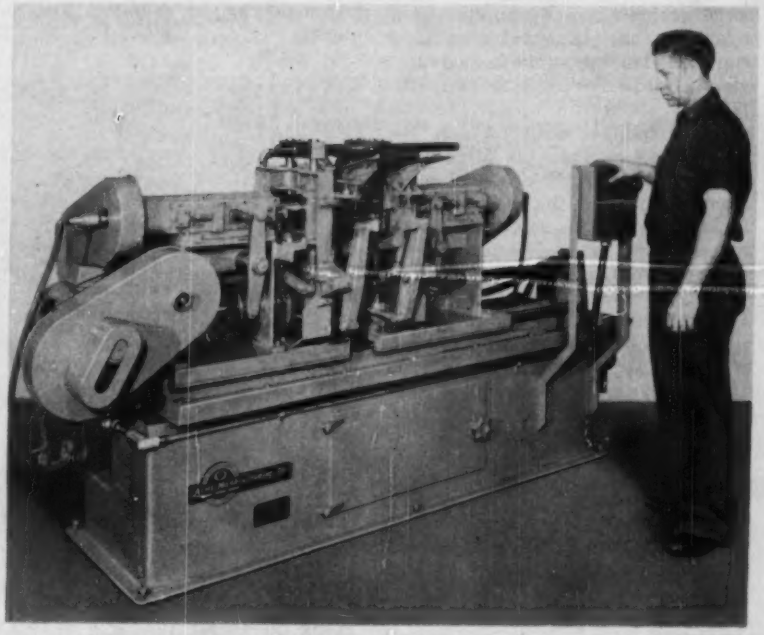
Two flute single end, two flute double end, and four flute double end Thriftmills have been added to line. The single flute tool has 30° helical flutes and right hand cutting. The shank is same diameter as cut.

The two flute double end tool has 30° helix, 10° rake, is right hand cutting and recommended for cutting most conventional materials. It is especially suited for profiling, peripheral milling, and general end milling work.

All three tools come in six sizes: ⅛, 3/16, ¼, 5/16, ⅜, and ½ in.

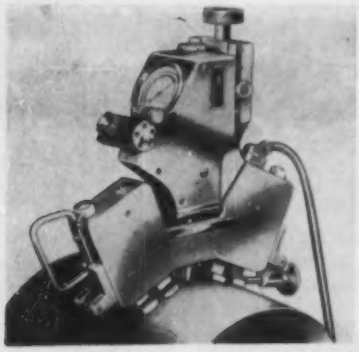
Cutting Tool Division, Brown & Sharpe Mfg Co, Providence 1, RI

MORE DATA? Circle 78, inside back cover



DOUBLE END DEBURRING MACHINE automatically chamfers the ID, OD, and face of tubular steel parts of various diameters and lengths. Tubing from ¾ to 2¼ in. diameter and from 2½ to 24 in. long can be deburred by this machine at production rates up to 6000 pieces per hour—*Acme Manufacturing Co, 1400 E Nine Mile Rd, Detroit 20, Mich*

MORE DATA? Circle 79, inside back cover



Portable Hardness Tester Speeds Flat or Curved Surface Testing

Designed with the same body as the Penetrascope Mark VIII, and made by the same British manufacturer, this new unit facilitates hardness testing of parts and in places that would normally be inaccessible. Vickers Hardness Numbers of either curved or flat surfaces can be obtained because the tester is held by an electromagnetic clamp having four pole pieces, two of which can be adjusted to accommodate different degrees of curvature.

New model is said to be especially useful for testing hardness of mill rolls. Tests can be made in grooves with minimum width of 2 in. and to depths of 7 in. Standard loads up to 30 kg are manually applied by a hydraulic unit. The indentor is a standard 136° pyramid-shaped diamond. Hardness ranges from 150 to 1100 dph are within capacity. Instrument is equipped with a 3½-in. objective and an indentor fitted to a sliding turret remotely controlled from the body of the instrument to facilitate testing in awkward places. Measurement of the impression is made by means of an optical indicating micrometer with an accuracy of ±0.001 mm. Standard model is designed to operate on 110/240 v and 4060 c ac. Chain clamp can be used for obtaining the hardness of nonferrous parts.

Steel City Testing Machines Inc, 8817 Lyndon Ave, Detroit 38, Mich.

MORE DATA? Circle 66, inside back cover

Heat Resistant Paint Protects Steel Jigs During Brazing

Heat-Rem H-170 Super, which protects steel jigs, fixtures, and formed products during brazing and welding operations, is said to withstand temperatures to 1700 F. Available in both aluminum and clear vehicles, the paint is especially recommended for fine tolerance work. It is claimed to be widely used on torch weld jigs on which rocket engine chambers are formed.

Speco Inc, 7308 Associate Ave, Cleveland 9, Ohio

MORE DATA? Circle 67, inside back cover

Portable Tool Permits Tapping ½-in. Diameter on any Drill Press

VersaTapper, which can be used on any drill press, makes tapping practical in any material and at any diameter from 0-½ in. The unit works equally well on tool steel, mild steels, and nonferrous materials.

Principle advantage of the unit is that it can be installed on a drill press in less than a minute's time. After tapping is completed, the attachment can be removed just as quickly.

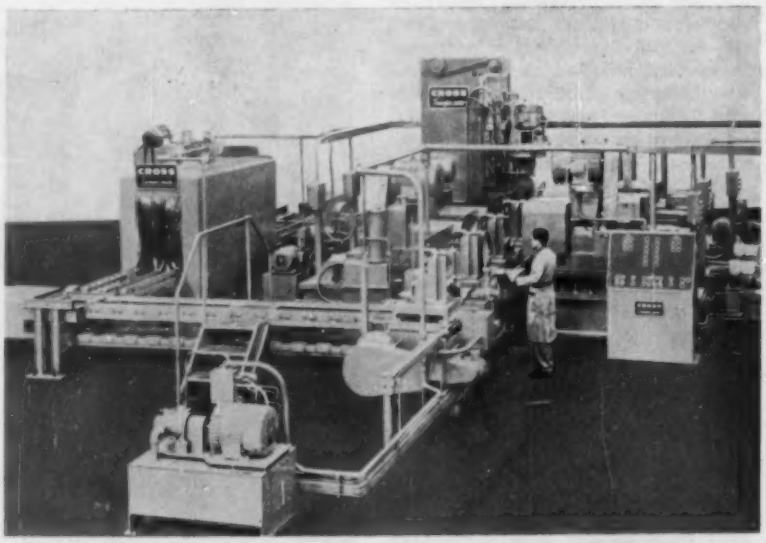
There are two models. Model 6100 has a straight shank and is held in the regular ½-in. drillpress chuck. Model 6200 has a No. 2 Morse Taper Arbor for attachment directly to the drill press spindle. Model 6100 is fastest to install and is best for user who does only occasional tapping jobs.

Supreme Products Corp, 2222 S Calumet Ave, Chicago 16, Ill

MORE DATA? Circle 68, inside back cover

ECONO-BORE COUNTERBORE comes with replaceable blades in 24 standard sizes. Blades of the same thicknesses can be used with different shanks and pilots. Regardless of size, each blade costs only $1.50—*The Do-All Co, Des Plaines, Ill*

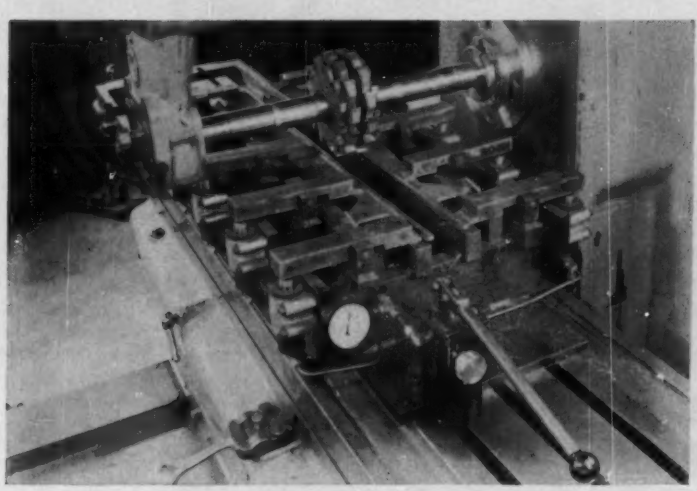
MORE DATA? Circle 69, inside back cover



FOUR DIFFERENT TRACTOR REAR-AXLE HOUSINGS, weighing up to 175 lb, are produced at 28 per hour to meet production requirements. All roughing operations are done in one station and all precision finish boring and facing operations on both ends of housings are completed in another, thus maintaining close alignment tolerances between the two ends. Tolerance held is ±0.001 in. —*Cross Co, Park Grove Station, Detroit 5, Mich*

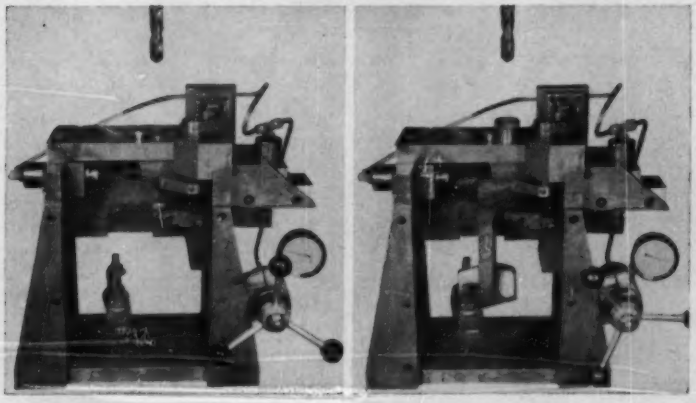
MORE DATA? Circle 70, inside back cover

How other shops clamp down on loading time...



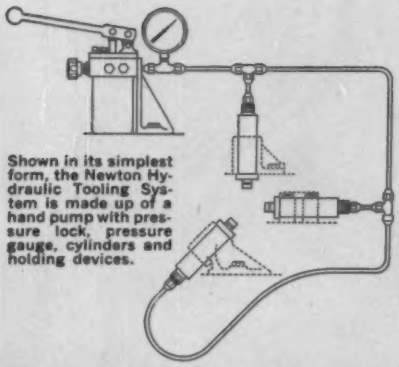
TRIANGLE PACKAGE BOOSTS PRODUCTION 335% . . .
reports Michael Zolnierczyk, Triangle Tooling Supervisor. Former floor-to-floor time, using mechanical clamping, averaged 57 minutes per piece or over 142 hours per 75 pairs. With Newton Hydraulic System, average floor-to-floor time has been cut to 17 minutes per piece, or 42 hours per 75 pairs, including set-up time. "The above figures," states Mr. Zolnierczyk, "represent a saving of 40 minutes per piece part, which is a production gain of 335%." Photo above shows Newton Hydraulic Tooling System installation machining fragile guide rails for conveyor system of meat packaging machine.

(The Triangle Package Machinery Company, Chicago, Illinois, manufactures filling, packaging and wrapping machines of particular importance to the food industry.)



R & H MACHINE SERVICE CLAMPS ODD-SHAPED PARTS RAPIDLY . . .
according to Robert Miller, Chief Engineer, who says: "The new Newton Hydraulic Clamping System is readily applied to a drilling jig for an odd-shaped casting, which would be awkward to clamp by other methods. Shown above are views before and after the part is positioned for drilling." Adds Mr. Miller, "Clamping and unclamping are far more rapid than would be possible with manual clamps. Pressure is uniform regardless of small variations in the size of castings or parts. Economy is another advantage. All the units, with the possible exception of some of the piping, can be used over again on other jigs and fixtures."

(R & H Machine Service, Cincinnati, Ohio are special machinery and tool builders.)



Shown in its simplest form, the Newton Hydraulic Tooling System is made up of a hand pump with pressure lock, pressure gauge, cylinders and holding devices.

Newton Hydraulic Clamping can speed up your production, too . . . . .

Newton System permits rapid operation of clamps in jigs and fixtures in a matter of seconds compared with the minutes lost by mechanical clamping. System consists of actuating pump feeding a number of clamping cylinders with hydraulic fluid under pressure. Extremely versatile, any number of cylinders usable up to pump's capacity. Various clamping positions facilitated. Pre-determined line pressures up to 2500 psi, are rigidly controlled. System provides easy, safe operation in confined work areas. Entirely self-contained unit. Screw or lever pumps, equipped with pressure locks, available in 2 sizes. Cylinders in varied size ranges. Hydro-pneumatic intensifiers also available for utmost clamping speed.

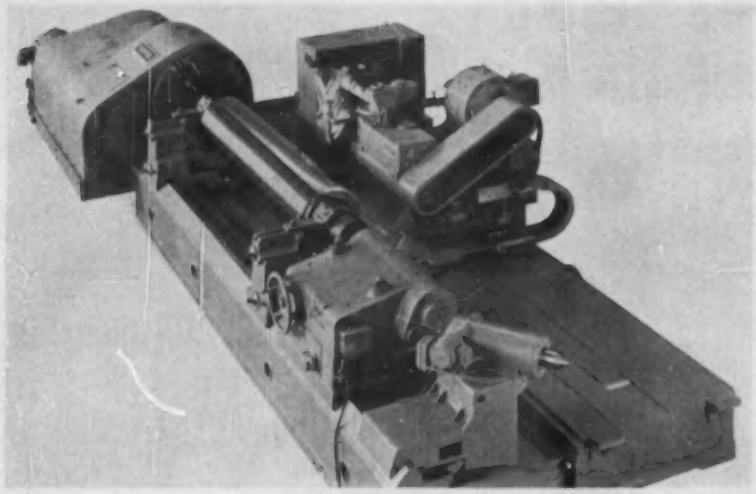
HYDRAULIC SYSTEM ASSURES:

- **Maximum reduction in clamping time**
- **Multiplicity of clamping positions**
- **Fast clamping of odd-shaped parts**
- **Controlled clamping pressures**
- **Decidedly safe, economical operation**
- **Movable self-contained units — independent of outside power**
- **Wide range of pumps, cylinders, and mounting devices**

A Newton engineer will be pleased to show you the efficiency and economy found in hydraulic clamping. Simply fill out and mail the coupon below.

NEWTON
HYDRAULIC TOOLING CO., INC.
AUBURN, MASSACHUSETTS

NEWTON HYDRAULIC TOOLING CO., INC., AUBURN, MASS.
I would like more information about Newton Systems.
☐ Send literature ☐ Send representative
NAME & TITLE:_____
COMPANY:_____
ADDRESS:_____
CITY:_____ STATE:_____



Farrel 60-in. Heavy-Duty Roll Grinder Claims Advanced Accuracy in Precision

Representing first of new design series 36-72 in. heavy-duty roll grinders, this 60-in. diameter capacity roll grinder will be used for grinding steel mill rolls up to 20 ft in overall length. Significance of machines lies in design of wheel-feed system, which provides a control precision said to be impossible previously in roll grinders.

Heart of design is trunnion-tilt pivoted infeed system employing the same method of wheel feed as is used in standard Farrel cam crowning action. Wheelhead no longer slides on ways during infeed, but is tilted into work in the same manner that crowning of the roll is accomplished. Since infeed system is always preloaded in one direction, positive infeed and withdrawal of grinding wheel can be accomplished to accuracies hitherto unobtainable.

For manual control, handwheel for infeed is graduated to 0.0001 in. For motorized control, rapid infeed is accomplished by push-button control at 28 in. per min and medium feed at 2 in. per min.

Farrel-Birmingham Co Inc, Ansonia, Conn

MORE DATA? Circle 62, inside back cover

102-in. Horizontal Rotary Table Has Accuracy of 5 sec of Arc

Reported to be one of the largest precision rotary tables ever built, with a bearing load capacity of 90,000 lb, unit is designed primarily for inspection and machining operations.

Accuracy is certified by auto-collimator reading. Preliminary rotation positioning is achieved by a visible counter reading from 000 to 359°. Final position is manual and, with the aid of a microscope which provides minute and second adjustment to permit zeroing in on a precision-graduated band, positioning within 5 seconds of arc is easily attainable. Additional features include adjusting speed motor drive from zero to 1/3 rpm (108 ipm); high capacity cone worm gearing with positive backlash controls; de-energized self-locking brake; platen and spindle assembly supported by X-Type roller bearing plus auxiliary outer anti-friction bearing supports; faceplate provided with T-slots and machined annular grooves at 2-in. intervals.

Machine Products Corp, 6771 E McNichols, Detroit 12, Mich

MORE DATA? Circle 64, inside back cover

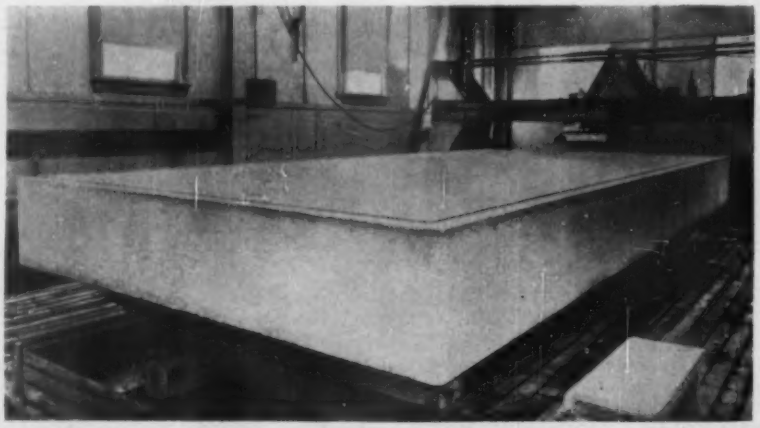
Remote Control System Offered for Forging Hammers

A power-assist control system for large single and double frame forging hammers, designated Power/Trol, replaces the two heavy, frame-mounted valve levers on hammers of 2500 lb and larger. With it, manufacturer claims, the control console can be located within 20 ft of the hammer—away from intense heat and flying scale. Operator has an unobstructed view of the forging operation from the console and can better communicate with his crew.

Chambersburg Model L high frame or double frame forging hammers can now be purchased with the Power/Trol system. In addition, kits are available for installing the system for Chambersburg flat die hammers already in service.

Chambersburg Engineering Co, Derbyshire St, Chambersburg, Pa

MORE DATA? Circle 63, inside back cover



OVERSIZE GRANITE SURFACE PLATES, constructed entirely in one piece, are manufactured from Balfour pink and Mt Airy gray quartz granites. Automatically controlled finishing machine smooths and polishes final surface to produce uniform accuracy. Range of sizes is available up to 50 ft long. Model illustrated is 20 ft x 10 ft x 22 in.—*Herman Stone Co, 1860 N Gettysburg Ave, Dayton 27, Ohio*

MORE DATA? Circle 65, inside back cover

The business end of Stanley's new heavy-duty Router is equipped with Adamas Grade A carbide. These versatile tools cut, shape and trim many types of materials.

...select ADAMAS for Carbide

■ There are always universally recognized leaders in every field . . . in electric tools—one of these is Stanley. Ever watchful of this unquestioned leadership, Stanley selects only component materials that meet its own exacting standards of quality. Every piece of original equipment must pass rigid specifications.

If you need a specific grade of carbide to use in your plant, or to build into your product, Adamas can offer helpful recommendations for your individual requirements. Experienced Adamas engineers are available for consultation without obligation.

An inquiry will bring a prompt response.

Producers of Tungsten Carbide Tools, Tool Tips, Dies, Wear Parts, Dee-A-Tool

ADAMAS CARBIDE CORPORATION
KENILWORTH, NEW JERSEY

PROGRESSIVE CARBIDE USERS SELECT BY Performance ... NOT HABIT!

HERE'S HOW ADAMAS CARBIDE HELPS STANLEY MAINTAIN ITS SUPERIOR POSITION . . .

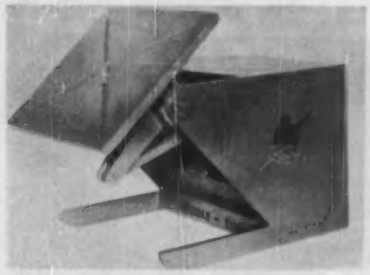
STANLEY

This famous trademark distinguishes over 20,000 quality products of The Stanley Works, New Britain, Conn. —made in 24 plants in the United States, Canada, England and Germany.

Shown discussing the quality requirements for a new Stanley product, are (l. to r.) James Scalise, General Foreman; Raymond Nagy, Adamas Representative; Milford Burrows, Research Manager.

Precision OD grinding at Stanley Electric Tools . . . The finishing operation—back-off or relieving flutes—is on Adamas Carbide tipped tools.

Stanley inspector, Angeline Jurewicz, at one of the many quality control stations, checks the finished carbide parts prior to assembly into Stanley products.



Toggle Tilt Work Positioner Simplifies Weldment Handling

Adaptable to a variety of applications, the machine rotates and tilts the turntable electrically to permit downhand welding. Turntable is T-slotted diagonally to allow work to be clamped securely. Unit features a new toggle lever, and the segmented drive gear design tilts the table and delivers maximum thrust with minimum horsepower. Design also eliminates shock load on gear teeth and overload gear damage. Table rotation is accomplished by means of a new internal ring gear providing not only greater transmission efficiency and increased protection for gear teeth, but reduced backlash as well. Additional feature is its highly-conductive aluminum alloy bearings which transmit electrical current directly to the spindle and require no special grounding.

Welco Toggle Tilt Positioners are available in capacities from 2500 to 25,000 lb with table heights from 34½ to 95 in. The 30-54-in. square turntables tilt through a 135° arc. Units may be ordered with non-electronic (20:1 ratio), electronic (100:1 ratio), or precision (full rpm with two cycles) variable speed controls.

World Electric Co, 4614 Prospect Ave., Cleveland 3, Ohio

MORE DATA? Circle 105, inside back cover

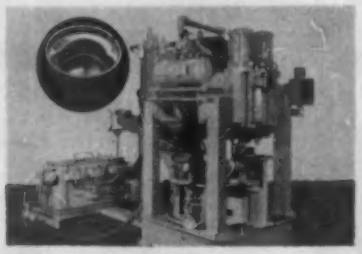
Dundick Pin, Plug Gages Are Precision Ground, Heat Treated

Lines of both precision pin type gages and tri-lock plug gages are precision ground and lapped from Swedish-type oil hardened tool steel, heat treated to Rh63-65 C. Also, special sliding drawer steel cabinets are available free with complete or sectional sets.

Pins are precision ground in all sizes from 0.030-0.750 in increments of 0.001 in. with guaranteed tolerance of ±0.00005. Line includes 721 sizes. The 251 "go" and "no-go" members of tri-lock line are also in increments of 0.001 in., with guaranteed tolerance of ±0.00007. Each member is easily identified by size engraved on it. Complete price is $2.75 per member in lots of four or more.

Dundick Tool Works, Inc, 3410 W 31st St, Chicago 23, Ill

MORE DATA? Circle 106, inside back cover



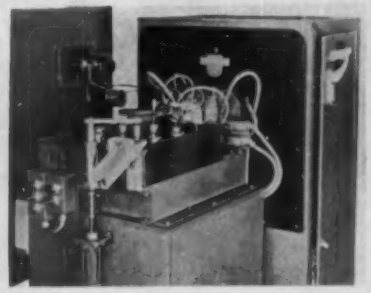
Automatic Stud Welder Uses Machine Screw Products as Studs

Special high-speed machine eliminates cost of conventional studs by enabling simple machine screw products to be used in their place. An example of its advantageous use is in the refrigerator compressor business. Previously an expensive arc-welding process requiring the purchase of ferruled studs was employed to weld studs to the inside of one-half of the compressor housing. Approximately 200 pieces per hr can be handled with 80% efficiency.

The stud welder is a four station index machine. At the welding station, operator loads studs into the two welding heads placed to assure close decimal tolerance of the stud location. As housing is indexed under the heads, operator pulls two safety handles, welding the studs to the inner surface of the housing.

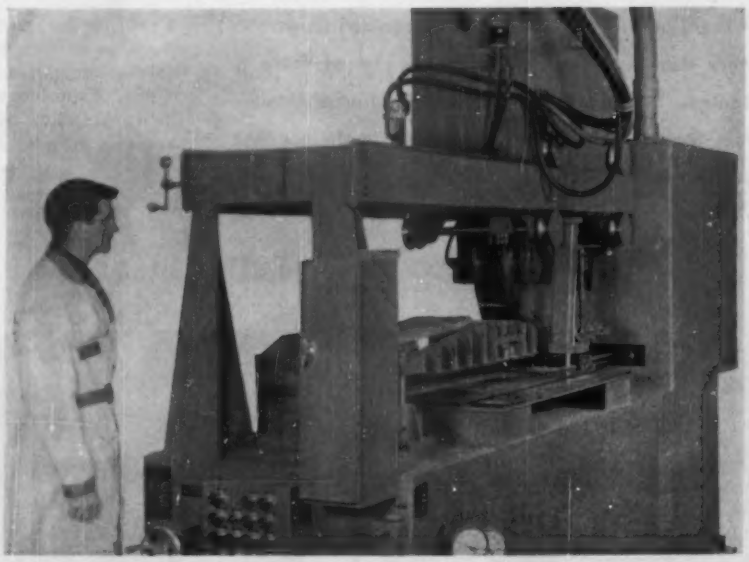
Progressive Welder & Machine Co, 915 Oakland Ave, Pontiac, Mich

MORE DATA? Circle 107, inside back cover



TRUNNION BEARINGS are internally hardened at rate of one every 6.8 seconds by this Ther-Monic induction heating unit which rotates automatically to position parts beneath the work coil, then ejects finished part onto chute. Work station and fixture are operated by a start button which controls entire cycle. Power is supplied by a 25-kw generator—*Induction Heating Corp, 181 Wythe Ave, Brooklyn, NY*

MORE DATA? Circle 108, inside back cover



TRAVEL-HEAD, SERIES SEAM WELDER joins strip ends together for continuous processing in tinning, annealing, and coil prep lines. Two punches pierce strip during clamping to identify weld during later operations. Total time for shearing, strip handling, punching, and welding a 48 in. weld strip is 12 sec—*Taylor Winfield Corp, 1048 Mahoning Ave, Warren, Ohio*

MORE DATA? Circle 109, inside back cover

GENERAL ELECTRIC

Developed Exclusively for Tri-Clad* '55' Motors

NEW THERMO-TECTOR SYSTEM POSITIVELY

ELIMINATES OVERLOAD BURNOUT

Allows Maximum Motor Output – – Safely!

Now—Tri-Clad '55' motors have simple, direct-acting thermal protectors that *positively* end winding failures from overloads!

New Thermo-Tector heat-sensing switches buried in stator windings react *instantly* to prevent heat damage. Unique Thermo-Tector "anticipation" feature varies motor shutoff point according to rate of winding heat rise. This ends need for operating safety margin.

Thermo-Tector system uses no costly amplifying relays or special circuitry, works with any General Electric motor controller.

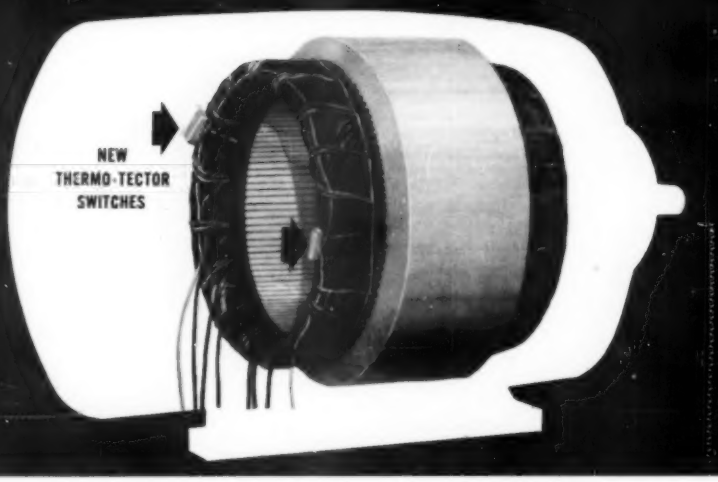
*Registered Trade mark of General Electric Co.

TURN PAGE FOR FURTHER INFORMATION

NOW!

GET MAXIMUM MOTOR OUTPUT WITH NO DANGER OF OVERLOAD BURNOUT!

New THERMO-TECTOR System
Operates IN THE STATOR . . .
Protects Under All Conditions!

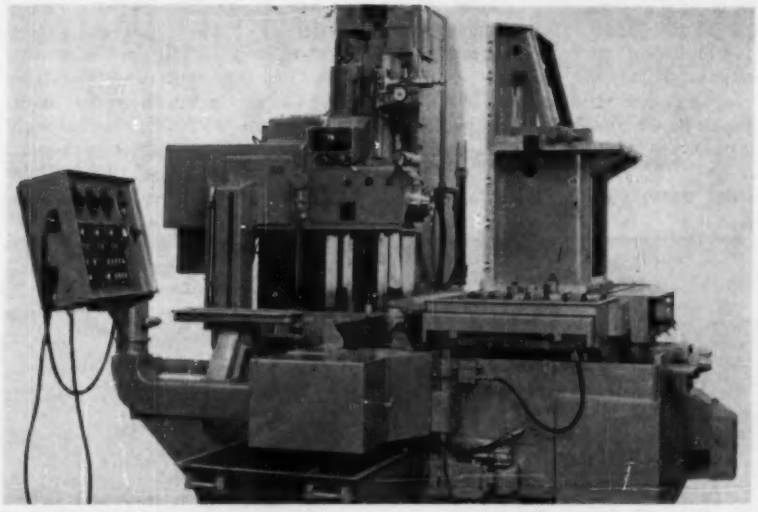


You get *full output* from Tri-Clad '55' motors with Thermo-Tector protection. No operating "safety margin" is necessary since Thermo-Tector switches react instantly to prevent damage from *any* type of winding overload. New General Electric Thermo-Tector switches—buried deeply in the coils of the Tri-Clad '55' motor—are so durable they handle size 4 contactor coil current with *no costly amplifying relays*. Any conventional G-E motor controller works with the Thermo-Tector system.

Thermo-Tector protection is available on *all* Tri-Clad '55' motors in frames 254U-445U. For more information, contact your G-E Apparatus Sales Office or write for Bulletin GEA-7092, Section 866-2, Schenectady 5, N. Y.

SMALL AC MOTOR & GENERATOR DEPARTMENT

GENERAL ELECTRIC



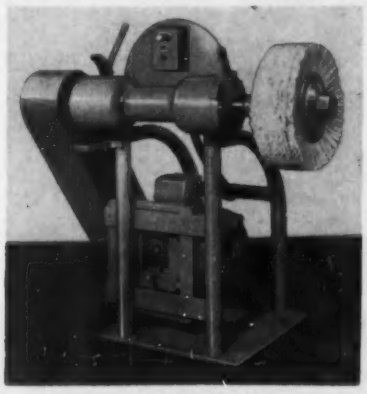
P&W Horizontal Spindle Milling Machine Control System Features Transistors

Keller Model "C" BL milling machine with tracer control was shown at Pratt & Whitney's May Centennial. This transistor-controlled milling machine is designed especially for tracer control and it will reproduce any two-dimensional templet or three-dimensional model. The Model "C" will handle the most complex or irregular dies, molds, prototypes, and any other pieces that cannot be conveniently or economically machined by other methods.

Machine, completely under push button control, has 15 hp spindle drive motor, with timing belt drive. Spindle speeds range from 40-3600 rpm and all controls are located on one panel.

Pratt & Whitney Co Inc, West Hartford 1, Conn

MORE DATA? Circle 80, inside back cover



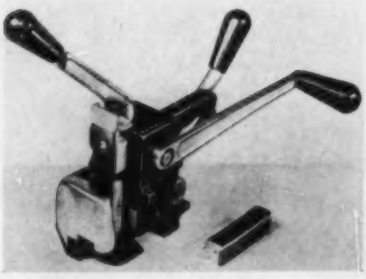
Low Cost Finishing Lathe Has 10 to 20-hp Capacity

Simplified design of this new lathe eliminates excess cast iron and expensive inside-base adjustments. Practically the entire cost is allocated to a top quality spindle assembly which is mounted on a simple, sturdy structural base. Carbon alloy steel spindle runs in permanently lubricated bearings within a rugged cast iron housing; labyrinth seals prevent dirt from entering. Bearing life is preserved by provision for spindle expansion under operating conditions. Bearings are placed on wide centers for greater rigidity and better distribution of work pressures.

Spindle is driven by multi-V-belt sheaves which can be replaced by removal of a guard; speeds are varied by changing the motor sheaves. Lockpin holds the spindle stationary for work wheel replacement. Distance from spindle housing to inside wheel flange is 8 in. and width between flanges on standard lathe is 6 in. Arbors may be ordered in 1½ to 2-in. diameters. Floor area requirement is 43 by 34 in.

Murray-Way Corp, PO Box 180, Birmingham, Mich

MORE DATA? Circle 83, inside back cover



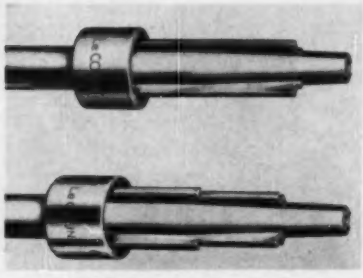
Strapping Tool Combines Tensioning, Sealing, Scoring

Model 2302 strapping tool, which combines tensioning, automatic placement of seals, sealing and scoring of steel strap, handles ½ and ⅝-in. strap in gauges of 0.015 to 0.023 in. and holds 50 seals in a clip-type magazine. Seals are automatically fed onto the tensioned strap so that one motion crimps the seal and scores the strap for easy break-off.

A continuous take-up on the unit permits feeding strap directly from a coil, eliminating wasted strap and lost time needed to precut strap. The tool scores strap for easy break-off, leaving strap in operator's hand ready to be inserted into tool for next cycle.

A J Gerrard & Co, 400 East Touhy Ave, Des Plaines, Ill

MORE DATA? Circle 81, inside back cover



EXPANDING MANDRELS are exact to 0.0001 inch tir. Eleven step-jaw models provide a range of ⅜ to 7 in. and 14 straight-jaw models provide a range of ⅜ to 3¼ in.—*LeCount Tool Works, Inc, 38 Cody St, West Hartford 10, Conn*

MORE DATA? Circle 82, inside back cover

High-Temp Pipe and Tubing Has High Corrosion Resistance

New Stainless Full Finish Rock-Forged (FFR) pipe and tubing is available in sizes from 2½ to 4 in. IPS inclusive. Pipe is designed for high temperature, high pressure, and corrosive applications. Through the cold rock-forging process the weld is completely wrought. At 70 F, FFR is 15% to 20% stronger than seamless and 30% to 40% stronger at 1400 F.

Swepco Tube Corp, One Clifton Blvd, Clifton, NJ

MORE DATA? Circle 84, inside back cover

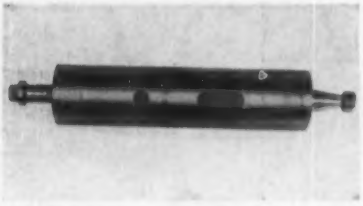
Heavy-Duty Air-Powered Routers Have Speeds to 15,000 rpm

61R Series with horsepower almost three times greater than previous models in the line are available for straight or contour cutting of metal, wood, plastic, and honeycomb. They range in capacity from ¼ to ½-in. collet and in speed from 6000 to 15,000 rpm. Governed air motor is reported to be capable of making cuts deeper, heavier, and faster than electric routers of larger rated horsepower without danger of motor burnout.

Additional features include precise depth-of-cut adjustment; self-cleaning operation; large front-end bearing to take radial and thrust cutting forces; full-grip collet; and thumb-flip throttle. It is available with maneuverable base for portable use or without base for fixture mounting. Power unit only weight 9½ lb, stands 9¾ in. high, sells for $285; Power unit with base costs $325. A ⅜-in. ID hose and 90-100-psi working air pressure are recommended.

Buckeye Tools Corp, 5003 Springboro Pike, Dayton 1, Ohio

MORE DATA? Circle 85, inside back cover



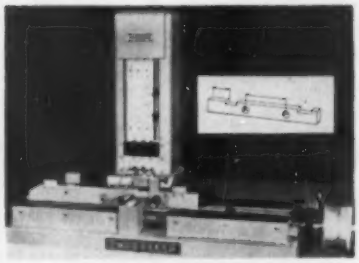
DoAll Offers Heavy-Duty Belt-Driven Tool Spindle

Heavy-duty belt-driven tool spindle, designated model BD4-2, is recommended for crush grinding, roll grinding, vertical spindle grinding and similar applications. It measures 4⅛ in. diameter, 16¾ in. long and operates up to 2700 rpm. Run-out is 0.0002 in. tir. Maximum recommended drive is 7½ hp and maximum wheel size is 14 in. dia by 2 in. width.

Use of four tapered roller bearings permits the spindle to take high radial and thrust loads. Special bearing location permits temperature expansion of the spindle without creating excessive thrust on the bearings or disturbing the grinding wheel.

DoAll Co, Des Plaines, Ill

MORE DATA? Circle 86, inside back cover



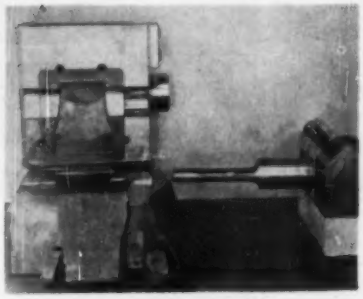
Precisionaire Gage Measures Slot Location to Millionths

Location of slots as small as 0.050 and smaller holes in long parts such as microwave components and computer bars can be measured to less than a tenth accuracy with a new Precisionaire. The instrument inspects hole location and centerdistance, slot width and depth of various shaped cavities in rectangular and round parts of various thicknesses and widths up to 12 in. long. Models for measuring other size parts can be supplied.

Gage consists of a precision-built gage table and a three-column Precisionaire instrument. A Sheffield one-inch range micrometer (located at one end of the table) guaranteed accurate to ± 0.000010 per in. is used in conjunction with end standards to set the part print dimension in the gage against which the actual location of the holes and slots in the part is checked. Interchangeable gage heads with leaf-type contacts that actuate Plunjet gaging cartridges are used to pick up hole or slot location and to measuer depth.

Sheffield Corp, Dayton 1, Ohio

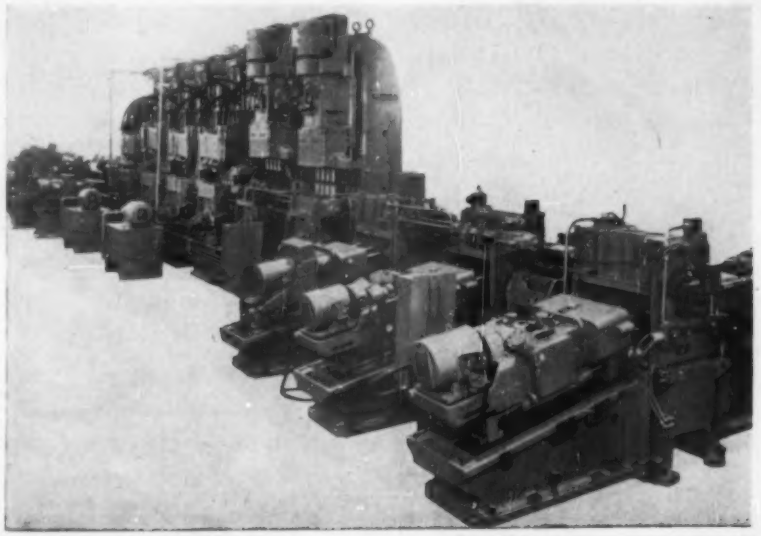
MORE DATA? Circle 87, inside back cover



German Upsetter Features Horizontal Gripping Dies

High production range of the Eumuco upsetter is made possible by the horizontal position of the gripping dies which allows a 180° approach to the forging area.

As an example, in the manufacture of axheads (illustrated), two tools are used. A piece of flat iron, which is used as the initial stock, is inserted



22 STATION TRANSFER MACHINE, with 81 spindles, machines automotive cylinder heads. It drills, gun drills and bores, taps, and spotfaces at production rate of 130 parts per hr—*Foote-Burt Co, Cleveland 8, Ohio*

MORE DATA? Circle 88, inside back cover

Our high speed steels are for performance

– exactly suited to your needs!

FIRST QUALITY · TOOL & SPECIAL STEELS · V-A

Whatever the major problem of the tool application—be it abrasion, impact, high temperature or other prevailing condition—Vanadium-Alloys has a *first quality* High Speed Steel grade to take it in stride. For the performance you need on the jobs you have, it's V-A all the way. Use the experience of our sales engineer in your district—his recommendations can make money for you!

Write for Data Sheets

Our 50th Year—
1910–1960

VASCO SUPREME: Highest hardness, highest wear resistance, supreme in the field. (U. S. Pat. 2174286.)

NEATRO: Resistance to abrasion exceeds all steels except Vasco Supreme. Excels for both heavy and light cutting.

VAN CUT: High carbon, high vanadium. Properties intermediate between Vasco M-2 and Neatro for easier grinding. Suitable for all types of cutting tools.

RED CUT SUPERIOR: The nation's best known general-purpose steel. Readily fabricated and heat treated. Shines in a host of applications.

VASCO M-2: The original 6-6-2 type steel. Wide hardening range, good machining characteristics, outstanding economy in service.

8-N-2: Low tungsten, high molybdenum, very tough at high hardness. Excels for fine edged tools.

VAN-LOM: High molybdenum, high vanadium. Best cutting performance of all high molybdenum steels.

Vanadium-Alloys Steel Company

GENERAL OFFICES: LATROBE, PA.

DIVISIONS: Anchor Drawn Steel Co. • Colonial Steel Co. • Metal Forming Corporation • Pittsburgh Tool Steel Wire Co.

SUBSIDIARIES: Vanadium-Alloys Steel Canada Limited • Vanadium-Alloys Steel Societa Italiana Per Azioni • EUROPEAN ASSOCIATES: Societe Commentryenne Des Aciers Fins Vanadium-Alloys (France) • Nazionale Cogne Societa Italiana (Italy)

CIRCLE 253 READER SERVICE CARD

in a pocket shaped engraving in the bottom die of the first tool where the advancing upsetting punch slightly compresses the piece. The slightly compressed workpiece is then inserted into the main engraving of the block. The gripping jaws move together, stamping out the shape of the axe, as the advancing piercing punch pre-pierces out the hankle opening with the exception of a small bunch which remains attached to the part. After a second heat the partly shaped axe is inserted into the second tool where the axhead is finish-formed.

Dist by Richard E Kleinhans, 122 E 42nd St, New York 17, NY

MORE DATA? Circle 89, inside back cover

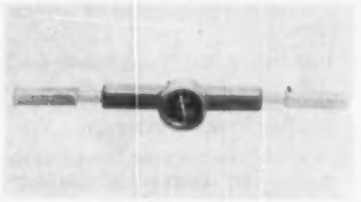
Sixteen New Tools Added To Union Tool's Line

Precision and machinist's tools include a line of six new micrometers measuring by 1/1000ths in capacities of 0 to 1 in. or 1 to 2 in. Prices are $13, $15.40, and $19.10 for the 1-in. micrometers and $14.50, $16.75, and $21 for the 2-in. models.

Other tools include combination squares and sets, 6-in. steel rules, speed indicator, pocket scriber, 9-leaf thickness gage, and surface gage.

Union Tool Co, Orange, Mass

MORE DATA? Circle 90, inside back cover



Double Handle Torque Wrench Gives Range of 0 to 100 Ft-Lbs

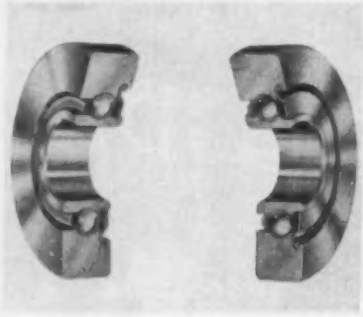
One-man torque wrench, recommended by manufacturer for use in confined spaces, gives a torque range of 100 ft-lbs with less than ¾ in. rotary travel.

Model TDF-100 torques both left and right. The torque bar is made of alloy steel which is said to retain its setting despite rough usage.

Having a 2½ in. OD, the dial's range is plus and minus 0 to 100 ft-lbs with minimum graduation equal to 5 ft-lbs. Smaller grads are available upon request. A larger size tool, Model TDF-600 for heavy-duty torquing, is also available. This has a range of plus and minus 0 to 600 ft-lbs.

Apco Mossberg Co, 1010 Lamb St, Attleboro, Mass

MORE DATA? Circle 91, inside back cover



Narrow Bearings Offered For Use in Instruments

New series of narrow-width precision instrument bearings is designed for use in synchros, gear trains, potentiometers, servos and small motors. Made to ABEC class 7 tolerances, the bearings are available in nine sizes with ODs from 0.2750 to 0.5 in. and bores from 0.0937 to 0.1875 in.

Miniature Precision Bearings, Inc, Precision Park, Keene, NH

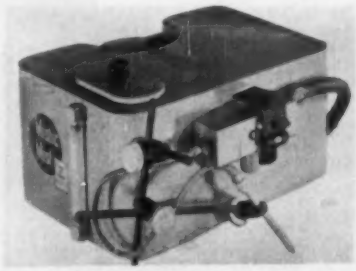
MORE DATA? Circle 92, inside back cover

New Single-Acting Cylinder Has 1-in. Bore, ¾-in. Stroke

Model BL-1 has a ½-in. ram drilled and threaded with 5/16-in.—18 internal thread to allow insertion of hardened face pad or 15° swivel pad. Ram end has 7/16-in.-dia wrench flats to facilitate ram-end length adjustment. Swivel or face pad has ½-in. adjustable length. Unit is also adaptable for other types of tooling. It is designed for clamping, work feeding, or ejection of parts. Swivel action of ram pad makes it especially suitable for clamping uneven workpieces. Cylinder may be mounted either horizontally or vertically. It can be used for air to 150 psi, oil water to 500 psi.

Superior Controls, PO Box 436, Commercial Rd, Crystal Lake, Ill

MORE DATA? Circle 93, inside back cover

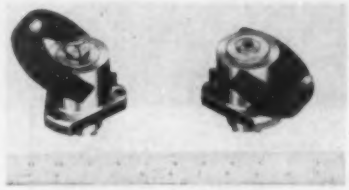


Mist Coolant Generator Has Automatic On-Off Feature

Model D-60 Mistic Mist is designed for use on drill presses having 2¾-in. columns. Air and coolant are controlled automatically by the up and downward movement of the drill-press spindle. Attachment of the tank to the drill column permits complete operator freedom and greater press work capacity. In addition to the on-off control, needle valves permit precision air and coolant flow, set to meet job requirements.

Aetna Mfg Co, 188 S York St, Bensenville, Ill

MORE DATA? Circle 94, inside back cover



Collet Holding Turntable Fixtures Allow Small-Area Index Setups

New line of fixtures takes 3C collets; small size will allow close grouping of several fixtures on small index tables. Horseshoe handle has hardened operating cam button. Height is 2-3/8 in. and flange area covered is approximately 3-3/8 in. in diameter. Allowance for lubrication, chip clearance, and mountings are predesigned by tapped holes.

Zagar Inc, 23886 Lakeland Blvd, Cleveland 23, Ohio

MORE DATA? Circle 95, inside back cover

Cut...Shaved...Ground...made from Punched or Turned Blanks...Ultra-Precision SPUR GEARING for all needs

FRACTIONAL HORSEPOWER GEARING

GEAR Specialties, Inc.

2635 WEST MEDILL AVENUE
CHICAGO 47, ILLINOIS

SPURS • SPIRALS • HELICALS • BEVELS • INTERNALS
WORM GEARING • RACKS • THREAD GRINDING

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARING

Whether you make appliances—sewing machines—office machines—instruments—or any other product which incorporates Spur Gearing, put your requirements in the capable hands of G.S. engineers and expert craftsmen.

"Precision" is the hallmark of all G.S. production—and rigid quality control systems keep that precision at its highest point all the way through quantity runs into the thousands. With the finest and most modern equipment in every department, with four-decade veterans in engineering, supervision and on the machines, we needn't (and don't) make any compromises with top quality in whatever we produce for you.

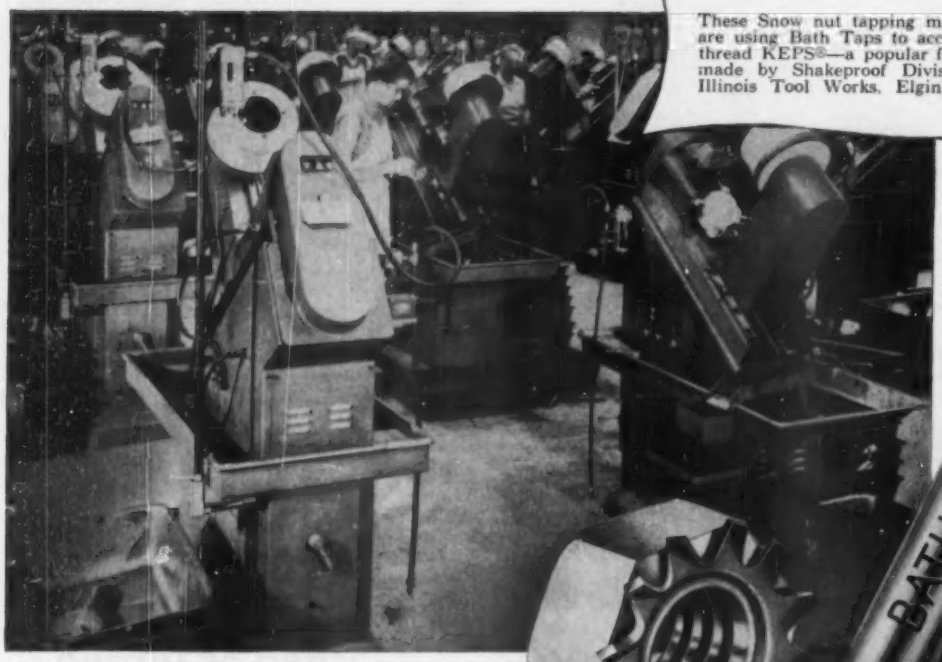
We're proud of the "blue ribbon" roster of customers—some of the largest, some of the smaller specialists—who have been relying on G.S. for years, whether their needs involve Spurs or some other form of Small or Intermediate Precision Gearing. Bring *your* Gear problems to G.S.—it's a great team to have behind your production!

•

SEND FOR G.S. *illustrated folder! See where and how we mass-manufacture Small Gearing to uniformly fine tolerances. Folder contains 23 pictures of Small Gears, plant view, Diametral and Circular Pitch Tables. Ask for your copy on company stationery, please!*

44 Years of Specializing in Small Gearing!

another Bath Tap job well done.....
for SHAKEPROOF®



These Snow nut tapping machines are using Bath Taps to accurately thread KEPS®—a popular fastener made by Shakeproof Division of Illinois Tool Works, Elgin, Ill

Tapping nuts is far from a "run-of-the-mill" job and the economy and precision of this operation is of prime importance in the manufacture of KEPS,® since these patented fasteners are used wherever accuracy and speed in assembly is vital.

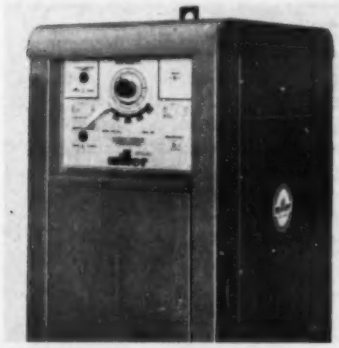
Shakeproof finds Bath Taps have "a very satisfactory production life and stand up well under high speed . . . holding tolerances of the finished part that maintains a fine gaging record" . . . another example of a Bath Tap job well done!

May we have our representative discuss with you, any threading problems that call for speed, accuracy and economy!

KEPS® — cold-formed nuts with free-spinning lock washers—are pre-assembled before being threaded by Bath Spiral Point Ground Thread Taps.

JOHN BATH & CO., Inc.
22 Mann St., Worcester, Mass.

PLUG CYLINDRICAL AND THREAD GAGES • RING THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS



TIG Welder Has Perfect Wave Balance Through Welding Range

Balanced wave TIG welder, model BWC-300MAP, is said to have perfect balance throughout the welding range, even during crater elimination, plus arc stability without high-frequency at current as low as 18 amps.

The dc component has been eliminated as a result of balanced wave welder circuits and specially designed transformer. Arc-outs during weld cycle are said to be impossible. A fail-safe reducer lowers the open circuit voltage when arc is struck or broken. There are five welding ranges with wide overlap.

Miller Electric Mfg Co, Inc, Appleton, Wis

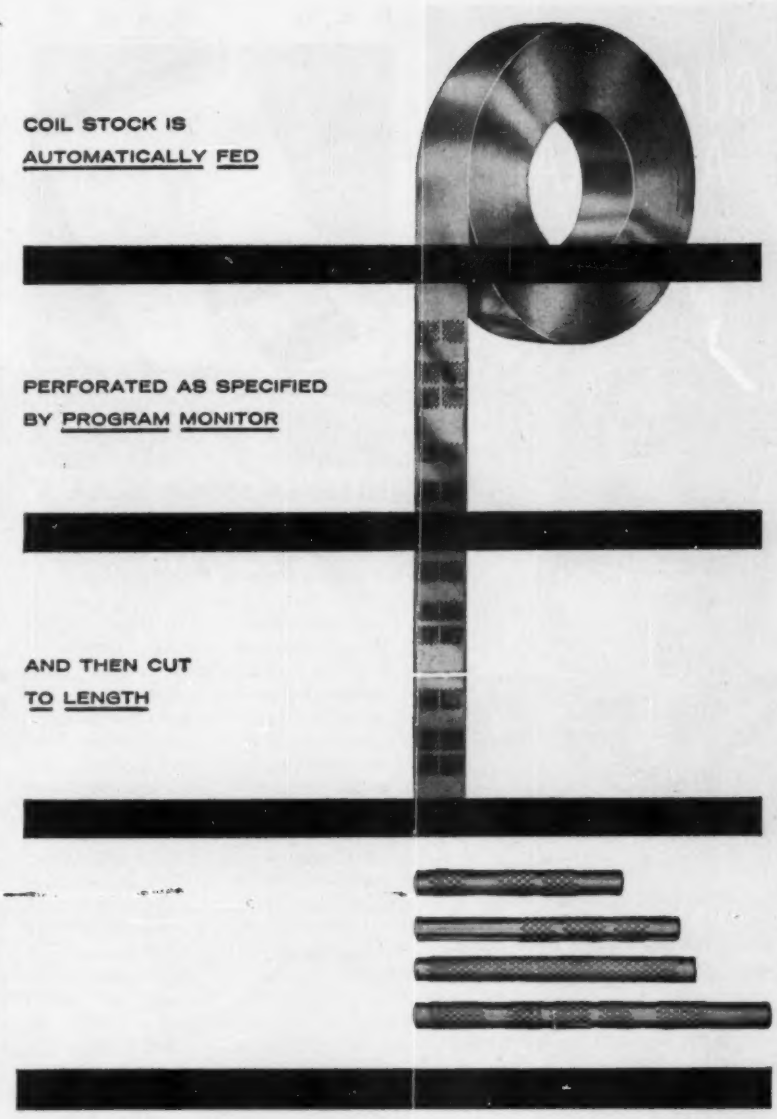
MORE DATA? Circle 96, inside back cover

60-w Soldering Pencil Has ¼-in. Tip

New soldering pencil is reported to be capable of doing the work of 100-w soldering irons yet weighs only 2 oz. A new stainless steel alloy for element housing, plus an unusual ventilation design, insures a very cool handle. Coated copper tip provides long life even under severe conditions required by the 60-w rating. Tip and element are separate parts, both replaceable independently. Designed for constant-duty work, pencil operates on any cycle, ac or dc.

Hexacon Electric Co, 135 W Clay Ave, Roselle Park, NJ

MORE DATA? Circle 97, inside back cover



PROGRAMMING WITHOUT TAPE WITH ONE SET OF TOOLS

Skip punching device, actuated by a repeating type counter, programs production of automotive muffler tube blanks in standard V & O inclinable press. Auxiliary counter controls blank cut-off. Varying perforation patterns are achieved with one set of tools. Integrating standard type mechanisms such as these to effect cost reduction illustrates the keen abilities that Emhart press experts can apply to your work improvement projects.

Emhart Manufacturing Co.
Hudson Div., Hudson, N.Y.
Formerly V & O Press Div.

EMHART

CIRCLE 256 READER SERVICE CARD

The Most for Your "Rockwell Testing" Dollar!

Clark Hardness Testers are *guaranteed* accurate for all "Rockwell Testing". Clark's exacting workmanship in the production of penetrators, testing blocks, anvils, and other accessories pays off in exceptional accuracy on the job. No wonder the low cost surprises our first-time customers. *Clark Instrument, Inc., 10201 Ford Road, Dearborn, Mich.*

FREE REFERENCE BOOK

All information about hardness testing in easy-to-read text with many illustrations. Just write "Send Book" on your letterhead. Description and prices for Clark Hardness Tester and free Hardness Conversion Chart also available on request.

CLARK INSTRUMENT, INC.
10201 FORD ROAD
DEARBORN, MICHIGAN

Missile-Age Accuracy

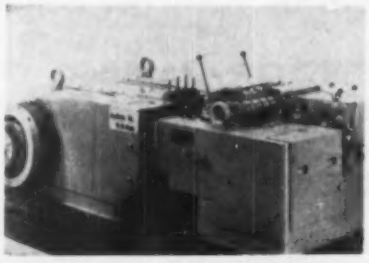
Kit Contains All Parts Needed For Building Complete Control

Control kit allows self-assembly of a simple control that will adapt to almost every electrically measurable variable. Heat of this "Pak-A-Trol" is a continuous reading meter-relay that permits simplified circuitry and instantaneous reset without the use of either interrupters or electronic circuitry. Included in the kit with the meter-relay are transformer, load relay, capacitor, resistors, rectifiers, and terminal block.

The four-inch black bakelite meter-relay is available in the most commonly used dc and ac sensitivities and temperature ranges: 0/1 milliamp dc; 0/100 microamp dc; 0/47 milliamp ac (with scale reading 0/150 per cent) for use with transformer to read virtually any ac signal 0/500° F; 0/1500° F; 0/2500° F; 0/50 millivolts dc; and 0/10 millivolts dc. The kit is priced at $97.50.

Assembly Products, Inc, Chesterland, Ohio

MORE DATA? Circle 98, inside back cover

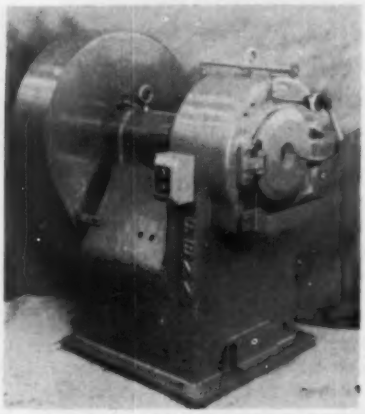


Multi-Stage Cold Transfer Header For High-Tensile Screws, Bolts

Malmedie (German) machine is available in several sizes; a similar machine is designed for manufacture of nuts. Unit has one shearing and four forming stages. New fully automatic feed indexing is said to provide absolutely uniform blanks, irrespective of timing. Strong shearing mechanism gives clean square cuts. There are separate adjustments of the ram slides and feed chucks. A ram-operated ejector for special shaped parts is also available. Machine is designed to be used with pre-assembled toolsets on swivel-mounted feed slides, reducing setup time to a minimum.

Dist by Straus-Artys Corp, 45 N Station Plaza, Great Neck, NY

MORE DATA? Circle 99, inside back cover



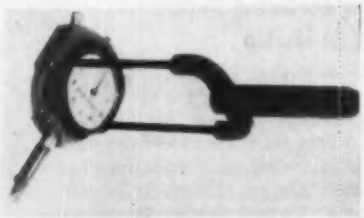
Long Die Swaging Machine Makes Tapers of 10-in. in Single Pass

Model 3½ F, with solid one piece Meehanite frame and spindle assembly produces tapers up to 10 in. long on tubing up to 1¾ in. diameter in single pass.

Also available is Model 4½ F that will produce tapers up to 15 in. long on tubing up to 2½ in. diameter in a single pass at production rate of six tapers per minute. Both machines will accommodate welded and seamless tubing of ferrous and nonferrous materials from stainless to aluminum.

Fenn Manufacturing Co, Fenn Rd, Newington, Conn

MORE DATA? Circle 100, inside back cover



BORE GAGE comes in three models, with ranges of 2½-4 in., 4-8 in., and 8-15 in. Featuring direct indicator reading, automatic bore centralization, and full indicator travel, the gages are said to have no heat transmission *—WJZ Tool Specialties, Hyde Park, NY*

MORE DATA? Circle 101, inside back cover

"this standard centerless wheel doubled our production rate"

"The performance of this wheel never ceases to amaze us. It has replaced three different wheels formerly used for the same operations. We are getting more pieces per dress, 15% faster infeed, and 20% to 52% longer wheel life. Our costs are much lower, you can be sure."

This manufacturer of shock absorber shafts has found that National Standards by Carborundum can save valuable time and real money. Be sure you are using the *right* wheels on your jobs. Call your Carborundum distributor for competent engineering service and specify "Job-Engineered" National Standards by

CARBORUNDUM®

Write for Catalog of National Standards by Carborundum to Bonded Abrasives Division, Dept. 81-012, The Carborundum Company, Niagara Falls, N. Y.

81-012

ELGIN DIAMOND

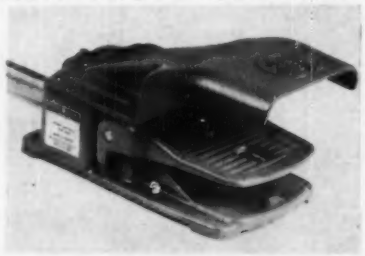
COMPOUNDED TO YOUR SPECIFIC NEEDS

If you're not getting a *true* micro-inch surface or extremely close tolerances when finishing hard-to-work materials, call your Elgin field engineer. He is a diamond specialist and whatever the material . . . hardened steels, carbides or ceramics . . . he will solve the problem of precision polishing and finishing by recommending an Elgin Diamond compound for your specific application. The Elgin Diamond compound he selects will be of the right grading and concentration for the best performance on your job. Your Elgin field engineer carries a microscope and will conduct an exacting visual inspection under actual production conditions at your plant. Write for the complete Elgin Diamond Compound catalog. For special assistance on your polishing or finishing problems call your local Elgin Diamond specialist or write:

Abrasives Division
ELGIN NATIONAL WATCH COMPANY
ELGIN, ILLINOIS

CANADIAN DISTRIBUTOR: B.S.A. TOOLS, LTD., 228 Norseman Street, Toronto 18, Ontario

NEW SHOP EQUIPMENT



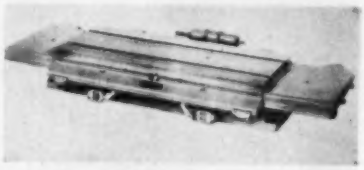
Snap-Action Foot Switch Designed For Control of up to 4 Circuits

Foot switch for applications requiring operation of a machine or process cycle while operator's hands are in use is made of cast iron to provide sufficient weight to minimize floor travel and tilting while operating. It can be secured to the floor.

Snap-action contact mechanism assures positive make and break. Maximum current rating is 40-amp make, 15-amp carry; max voltage is 600 v. Switch is suitable for use in control circuits of contactors or starters through NEMA size 4.

General Electric Co, Schenectady 5, NY

MORE DATA? Circle 102, inside back cover



2-Position Slide Table Provides Two Work Positions on Same Part

Indexing slide table provides working and loading-unloading stations or two work positions on the same part, and permits consecutive operations. Slide movement is powered by a 3-in. bore air cylinder or a 2-in. bore hydraulic cylinder. Stroke length is infinitely adjustable from 1 to 15 in. by means of Gilman system of hydraulic cushions and stops. Almost any type of slide cycle control can be obtained with the optional valve and electrical combinations which are available.

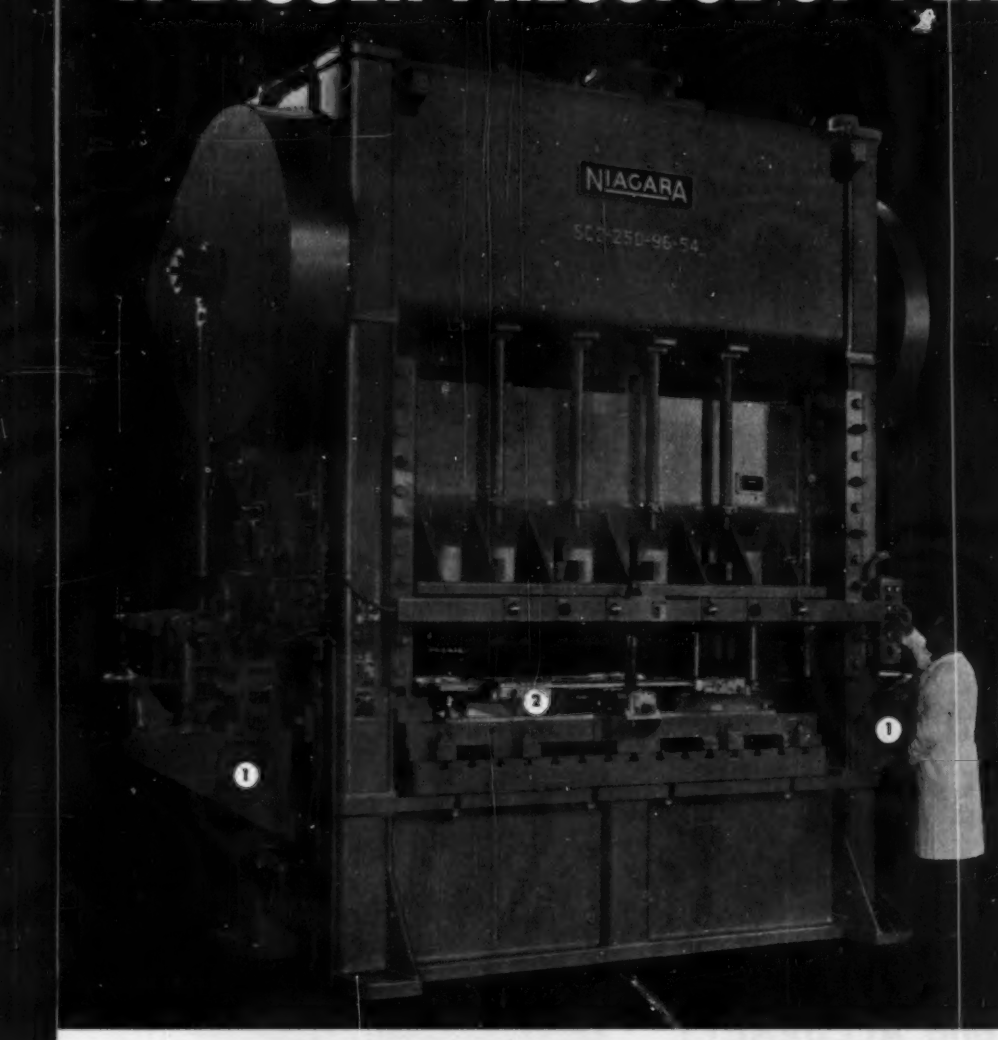
Working surface of the top slide member measures 30 x 12 in. and is provided with two longitudinal ⅝-in. bolt T-slots spaced 6 in. apart. Guards at either end keep the dovetail way covered in all slide positions. Applications include turret-type drilling machines, multiple drill head machines, multiple-spindle boring machines.

Russell T Gilman Inc, 683 Beech St, Grafton, Wis

MORE DATA? Circle 103, inside back cover

it's yours in the Niagara line!

A BIGGER PRESSFUL OF PERFORMANCE



- Rigidly built, all-steel frames of patented, triple box section design.
- Box-type, welded steel slides reinforced with heavy webbing.
- Extra long, adjustable gibs that fully contain the slide during working stroke.
- Laminated, non-metallic ways . . . an exclusive Niagara press feature to prevent scoring.
- Low-inertia pneumatic friction clutch and brake for trouble-free, high production.
- Centralized pressure lubrication.
- Operating controls conveniently arranged on master panel.
- Unusually liberal shutheight and extremely long slide adjustment to accommodate a wide range of stamping and forming dies.

TWO-IN-ONE FLEXIBILITY

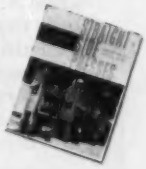
Here's a 250-ton Niagara Straight Side Double Crank Press, at contract metal stamping plant of Belmet Products, Inc., equipped with:

1. Roll feeds for progressive die work on coil stock.
2. Nine-station transfer feed mechanism and dies for work with pre-cut blanks . . . quickly removable as a self-contained unit.

Progressive die stamping . . . deep drawing . . . heavy blanking . . . lamination punching . . . you name it! Niagara Straight Side Single and Double Crank Presses are the profitable choice for numerous stamping requirements. No other line can match them in the middle capacity range. Once you've checked their operating and structural features, it's easy to see why.

Built in a combined range of 50 through 500-ton capacities, Niagara Series SC-1 and SC-2 Presses are available in non-geared, single geared or double geared models, with either single or twin-end drives. All can be outfitted with automatic feeds, adjustable speed drives, pneumatic die cushions, special controls and devices for automation.

Learn how you can get "a bigger pressful of performance." Be prepared for the next time you buy a straight side — single crank or double crank. Write for illustrated Bulletin 64. *Niagara Machine & Tool Works, Buffalo 11, N. Y., District Offices and Distributors Everywhere.*



NIAGARA straight side presses

SINGLE AND DOUBLE CRANK

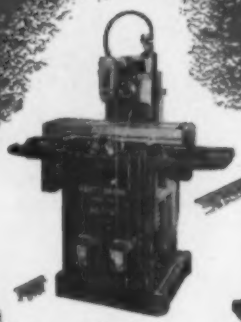
MMT PE

America's [illegible] line of presses, press brakes, shears, other machines [illegible] tools for plate and sheet metal work.

CIRCLE 261 READER SERVICE CARD

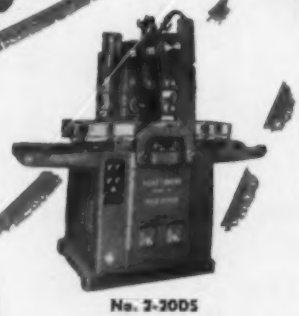
EXTRA RUGGED... SPEEDY... ACCURATE...

to Bring Down Milling Costs!



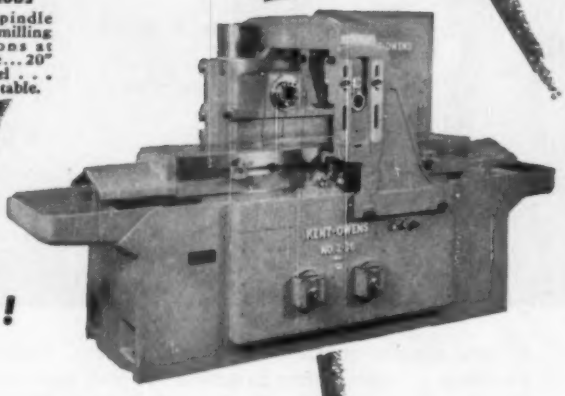
No. 1-14. 32" x 9" table... 14" table travel...hydraulic table feed... full automatic cycle.

No. 1-14DS
Double Spindle for two milling operations at same time ... 14" table travel ... 32" x 9" table.



No. 2-20DS
Double Spindle for two milling operations at same time... 20" table travel ... 42" x 12" table.

No. 2-20V
20" table travel... vertical spindle with speed range 32 to 1284 R.P.M. ... 42" x 12" table.



No. 2-20 ... 20" table travel ... 42" x 12" table ... full automatic hydraulic feed.

No. 3-36 ... 36" table travel ... 64" x 16" table ... full automatic hydraulic feed.

STEP UP SPEED and ACCURACY!

Put the work on Kent-Owens Machines for top-speed milling and topmost accuracy to keep your costs at a minimum! Advanced features throughout make the difference ... greater dependability ... accuracy maintained. Twin-post head mounting assures balanced load. Greater cutting efficiency—only two gear contacts, motor to spindle. Write for bulletin #757 on wide range of hydraulic and hand-operated machines. Let us quote on proper machine complete with tooling for your operation. Also, call on Kent-Owens for special machines. Kent-Owens Machine Co., Toledo, Ohio.

KENT-OWENS
for milling machines

See us at The Machine Tool Exposition Booth 547

KENT-OWENS REPRESENTATIVES

BOSTON
General Machinery Corp.

BUFFALO
Beesley-Hoffmann Mach'y Co.

CHICAGO
Four States Mach'y Company

CLEVELAND
Gorco Machinery, Inc.

DALLAS
Hauser Machine Tool Co.

DAYTON
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F. P. Barber Mach'y Company

FIELD REPORT...

Eastern Distributor Holds Machine Tool Show

"These people have taken time out of their day to come up here and look at these machines. It's not like the big shows where many of the visitors are simply enjoying a paid holiday." This pretty well sums up the reaction of builder representatives at the machine tool show held recently by Wm Halpern & Co, Inc, Mount Vernon, NY.

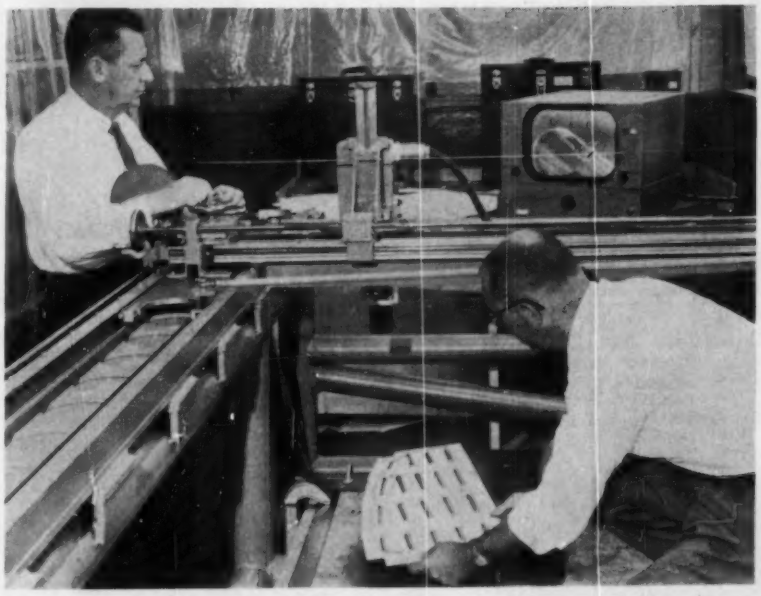
The four-day show featured such machines as the Brown & Sharpe Model A, ½-in.-capacity turret drill, and a line of B&S surface grinders. A Model 618 surface grinder with a built-in optical comparator (called Visual Grind) attracted considerable attention.

Cincinnati Lathe & Tool Co's new Hydrashift lathes featuring dial speed shifting, and Cincinnati's Spiropoint drill grinder, 21-in. sliding-head drillpress, and 16- and 18-in. low-price Royal drillpresses were also shown.

Among the big attention-getters were the Micro Path magnetic-tape-control system (demonstrated on an Index vertical miller), and the Warner & Swasey Probomat numerical positioning system (demonstrated on a Moore precision jig borer).

Jones & Lamson was represented by its precision boring and facing machine that guarantees repetitive accuracy to 0.0001 in. under production conditions. Wade Tool Co demonstrated a second-operation bench lathe with 2¼-in. collet capacity, and a precision toolroom screw-cutting lathe.

Other companies whose products were displayed included Aloris Tool Co (toolholders), Grob Inc (a bandsaw), Stocker & Yale (an optical projector that fits most machine tools to enable operator to check the cut closely), Index Machine & Tool (milling machines), Advance Products Corp (cross-slide rotary table).



"Universal inspection machine" for making a complete dimensional check of aircraft parts is built around a closed circuit TV system made by Kin Tel Div of Cohu Electronics Co. Interior of frame is open so that large sections to be inspected can be placed inside on a 2-ft-high table. Carriage that can be moved from one end of frame to the other holds camera on a bracket that can also be moved back and forth. Camera, facing downward, can then be moved to any position over inspection table; lens enlarges field of view about 30X and cross hair on lens aids in precise positioning. A 14-in. monitor shows operator exact position of camera over part to be inspected. Technique, developed and being used by Convair-San Diego, is said to effect inspection time savings ranging from 40 to 70%

Wyman-Gordon to Move Prex Forging Facilities East

Wyman-Gordon Co will expand its New England forging operations through transfer of its Prex, Franklin Park, Ill, facilities and production to its Eastern Division plants at North Grafton and Worcester, Mass. Transfer, which will take place gradually over a period of some months, coincides with increase in work with beryllium at North Grafton. Company has set aside extensive areas in the plant for its handling and production and Prex facilities will make it possible to expand this phase of operations. Prex, which was taken over by Wyman-Gordon in 1956, specializes in close tolerance, small precision forgings, largely in aluminum for the aircraft industry.

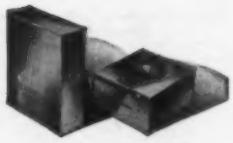
$15 Million Order to Siegler

Siegler Corp has an initial contract from the Convair-Astronautics Division of General Dynamics, San Diego, for automatic electronic launch control equipment for the Atlas. Work will begin immediately on production of equipment and will extend over a two-year period at the Hallamore and Hufford divisions.

McGIRK'S WORKS

by GEO. CRENSHAW

THE BELT ON THAT MACHINE IS DEFECTIVE. SEE THAT IT'S REPLACED IMMEDIATELY!
OKAY, BOSS. AS SOON AS I FINISH...
I SAID IMMEDIATELY! ON THE DOUBLE!
THAT'S BETTER!
MOE'S CORNER
A foreman talked to me like that JUST ONCE! But I didn't stand for it! Nosirree!... I stood up for my rights!!



Accuracy, Stability, Wear Life

These are qualities to look for in gage blocks—qualities you'll find finest by far in Ellstrom Chromium Plated Standards. Size, flatness, parallelism unconditionally guaranteed to closer specified millionths than any other blocks you can buy. Made only of time-tested materials fully certified for uniform hardness, absolute metallurgical stability. And gaging surfaces chromium plated by an exclusive Ellstrom process to give you longer wearing millionths, lower gaging costs. Next time you buy gage blocks, be sure you get the very best—be sure to specify

ELLSTROM CHROMIUM PLATED GAGE BLOCKS

MANUFACTURED AND CALIBRATED TO THE INTERNATIONAL INCH—EXACTLY EQUAL TO 25.4 MILLIMETERS

"W" Working Accuracy: +.000008"/−.000000"
Parallelism: .000004" / Flatness: .000004"
"I" Inspection Accuracy: +.000004"/−.000000"
Parallelism: .000003" / Flatness: .000003"
"L" Laboratory Accuracy: +.000002"/−.000000"
Parallelism: .000001" / Flatness: .000001"

Above: Ellstrom Rectangular Set No. 85-R. Left: Ellstrom Square Set No. 81-SA, with accessories.

New Catalog contains prices and specifications—send for it today!

Originators of Chromium Plated Gage Blocks

ELLSTROM STANDARDS DIVISION
DEARBORN GAGE COMPANY
22038 Beech Street • Dearborn, Michigan

*Ellstrom—*Measuring in millionths for three generations*

Hjalmar Ellstrom (1863-1942)—He gave mankind the key to mass production of interchangeable parts. For it was he alone who conceived and produced the world's first combination gage blocks—the first master reference standards accurate to the infinitesimal millionth part of an inch!

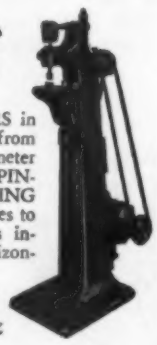
CIRCLE 264 READER SERVICE CARD

GRANT

RIVETERS — PIONEERS in their line — head rivets from smallest to ¾" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method — Sizes to meet all needs — Types include Vertical and Horizontal Multiple Spindles.

Write for literature and don't forget to send samples.

THE GRANT MFG. & MACHINE CO.
85 Silliman Ave., Bridgeport, Conn., U. S. A.



Field Report . . .

Numerical Control Seminar Proves Subject Can Be Handled Painlessly

More than 100 members of the Pacific Northwest metalworking industry attended a recent seminar on numerical control of machine tools at which not a single technical paper was presented. Dearth of formal papers was planned; sponsoring groups felt that discussions, and question and answer periods, would better serve the purpose of the seminar which was to provide a basic numerical control education that metalworking men could effectively put to use. Held at the University of Washington in Seattle, the two-day meeting was sponsored by its College of Engineering in cooperation with private corporations.

Some of the ways used to simplify the subject: a glossary of terms written in clear, concise language was distributed to those attending; question and answer sessions were held following each speaker's talk; an orientation film was presented, and visual aids were made use of whenever possible.

Program coordinators Irvine B Rabel, president of Star Machinery Co, Seattle, and Professor Richard Holt of the College of Engineering had on hand a panel of speakers made up of leading authorities from private industry. These were Kenneth G Wood, chief, equipment engineering and planning, Aero-Space Division, Boeing Airplane Co; Herbert P Grossimon, vice president, Concord Controls Inc, Boston; Robert G Chamberlain, supervisor of data processing, Giddings & Lewis Machine Tool Co, Fond du Lac, Wis; Carl W Haydl, director of control systems, Thompson Ramo Wooldridge Inc, Michigan

(continued on p 176)

"They started out to calmly discuss the pros and cons of selling machine tools to Russia."

The NASA-USAF-Navy X-15 manned rocket gets a vital part . . . delivered with jet-age speed by AIR EXPRESS

X-15 part flies first 3000 miles by Air Express

The scene: Edwards Air Force Base, Calif. Crack engineers work 'round the clock to ready the X-15 for its flight to the brink of outer space. Its engine, built by Thiokol in Denville, New Jersey, packs a 400,000 HP punch—more than the power of two giant ocean liners! Because of an accelerated assembly schedule, some parts—like this turbine pump control—are installed right on the flight line. They must be shipped fast, with kid-glove handling. In short, a job for low-cost AIR EXPRESS. Give your business these advantages, too. Call AIR EXPRESS to speed your products FIRST TO MARKET . . . . FIRST TO SELL.

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YOUR BEST GUIDE TO
1960's RECORD BREAKING EXHIBITS
OF METALWORKING'S
EQUIPMENT AND SUPPLIES

WILL BE FOUND
IN THE

Chicago Exposition Issue

of American Machinist / Metalworking Manufacturing

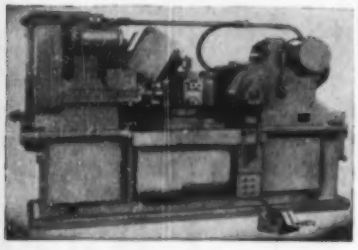
- a 200-page advance look at the Machine Tool Exposition, Production Engineering Show and Coliseum Machinery Show
- authoritative descriptions of "WHAT's NEW" in equipment, materials and supplies at each of the three expositions
- a preview to help you plan your Chicago visit to make the most valuable use of your time
- an authoritative reference for the things you examined and discussed during your visit
- a comprehensive trip through the three exhibit halls if you are unable to attend

To get the full picture of the Chicago exposition (all three shows) LOOK FOR THE

August 22, 1960 Issue of

American Machinist / Metalworking Manufacturing

THE BIGGEST (and most authoritative) ISSUE ON METALWORKING's BIGGEST SHOW



GOSS *and* DE LEEUW AUTOMATIC CHUCKING MACHINE

When any of the various functions for which this machine is designed are performed on it, no further machining is required. The job is finished.

The basic "1-2-3" method . . . exclusive with Goss & De Leeuw . . . provides for gripping work in the chuck and machining all ends either simultaneously or in sequence. By eliminating several handlings and set-ups, the "1-2-3" method produces finished pieces at a fraction of the time and cost ordinarily required.

Send samples of your work for time estimates. Ask for illustrated literature containing detailed information.

GOSS *and* DE LEEUW
MACHINE COMPANY, *KENSINGTON, CONN., U.S.A.*

Field Report . . .

City, Ind; David W Bottles, systems analyst, IBM, Santa Monica; and Henning V Nelson, systems application engineer, General Electric Co, Seattle.

Highlights of the first day's discussions included the role of numerical control in industry; an explanation of why numerically controlled machine tools will become a necessity; the advantages inherent in such systems; and an outline of the seven functioning areas required for a numerically controlled machine tool. Point-to-point system operation, programming, maintenance, and future probabilities were covered and discussed. Continuous path systems, as well as basic circuits for performance of required functions, were treated in detail on the second day.

Armed Forces in Sedans

A $2.3 million government contract for more than 1600 Ford sedans for the Army, Navy, Marine Corps, and Dept of Defense has been awarded to Ford Division of Ford Motor Co. Latest order, Ford's fifth multi-million-dollar contract this year, brings the Division's total military vehicle orders to more than $16 million since Jan 1. The four-door sedans will be built at 10 assembly plants with largest schedules assigned to the Dearborn, Mich, and Los Angeles facilities.

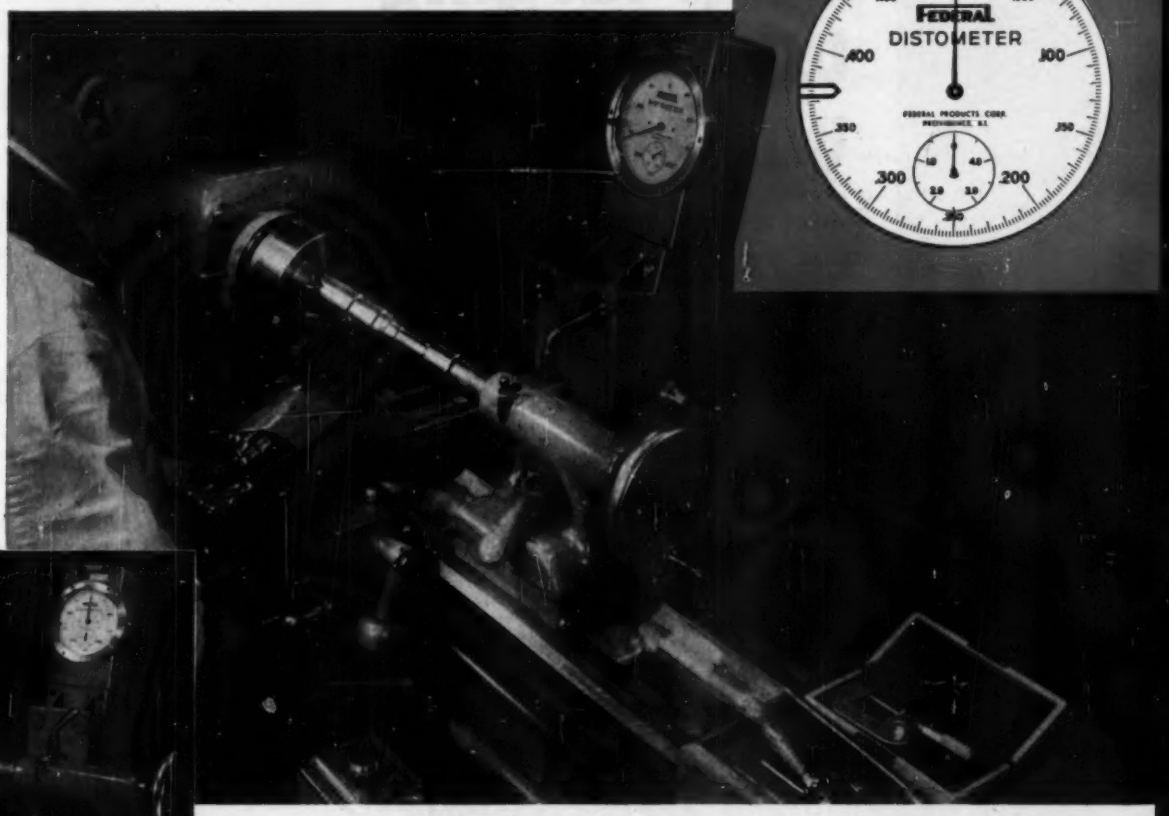
Gorham Tool Co Sold

George N Popham and associates have acquired Gorham Tool Co of Detroit, a leading manufacturer of high speed steel and carbide cutting tools. Transaction involved purchase of all stock in the 40-year-old concern for an undisclosed amount. Mr Popham, who has been president of Gorham for the past five years, re-

"How could you possibly confuse a form M319-R72A-42196 with a form M319-R72A-431962"

Right before your eyes...

A 27% (or more) INCREASE in LATHE PRODUCTIVITY!



Push-Button Zeroing . . . you're instantly and automatically ready to measure off the next distance.

The DISTOMETER, a totally new precision instrument, greatly increases lathe output . . .

Because —

- It provides a much faster, more convenient and more reliable means of spotting tool position and measuring longitudinal cutting distance than any other available device.
- It has motorized, Push-Button Zeroing. Lets you reference instantly at any point in the carriage travel for continuous measurement to any other point.
- It puts accurate, well magnified, man-size readings in front of the operator so he can follow progress of the tool and know instantly when it has covered the required distance.
- It requires no set up, no positioning, no mastering. Ready to measure *directly* at the touch of a button.

ANY MANUALLY OPERATED LATHE . . . OLD OR NEW . . . BIG OR SMALL . . . CAN USE THE DISTOMETER PROFITABLY!
Write for brochure.

FEDERAL PRODUCTS CORP.
6127 Eddy Street, Providence 1, R. I.

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .
Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging

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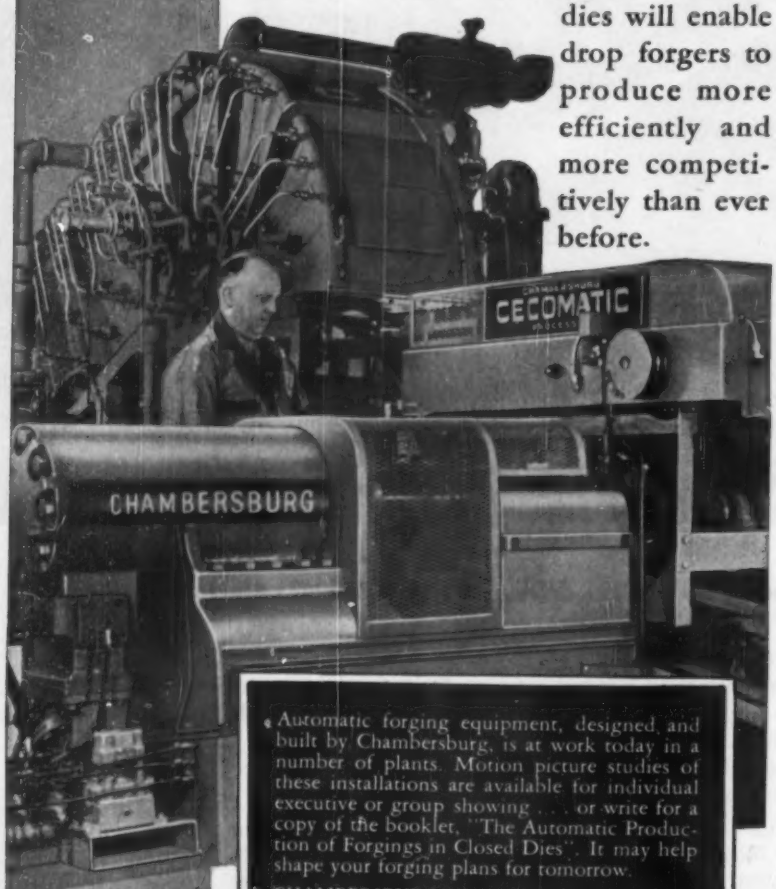
Mechanized drop forging will change your future!

The cost-cutting advantages of the automatic production of forgings in closed dies will enable drop forgers to produce more efficiently and more competitively than ever before.



Automatic forging equipment, designed and built by Chambersburg, is at work today in a number of plants. Motion picture studies of these installations are available for individual executive or group showing . . . or write for a copy of the booklet, "The Automatic Production of Forgings in Closed Dies". It may help shape your forging plans for tomorrow.

CHAMBERSBURG ENGINEERING COMPANY
Chambersburg Pennsylvania

CHAMBERSBURG

• The Hammer Builders •

DESIGNERS AND MANUFACTURERS OF THE IMPACTER

When it's a vital part, design it to be FORGED

Field Report . . .

ports that plans for expanding facilities are being programmed to provide capacity for new product lines to be introduced soon.

Bausch & Lomb Drops Optical

As of July 1, Bausch & Lomb Optical Co, Rochester, NY, will be known officially as Bausch & Lomb Incorporated. New name signifies the company's expansion in fields related to optical science, among them radiation measurement, and electronics, where optic-electronic instruments are being used to solve problems previously thought to be the province of electronics alone.

51 US Delegates Attend Standards Unification Conference

First major meeting since 1957 of the ABC (American, British, Canadian) Conference on Unification of Engineering Standards held this month in Ottawa, Canada, was attended by 51 delegates representing American industry and government. Included on the agenda were studies of numerous problems in the joint standardization of screw threads, bolts, nuts and screws, splines, and surface finish.

The ABC Conference was formed in 1944 during the war to unify the different screw thread systems which caused difficulty in production of items of equipment for common use. An agreement was signed in 1948 for unification of basic screw thread systems of the three countries.

"I think you'll find me very easy to please as long as your work is beyond reproach."

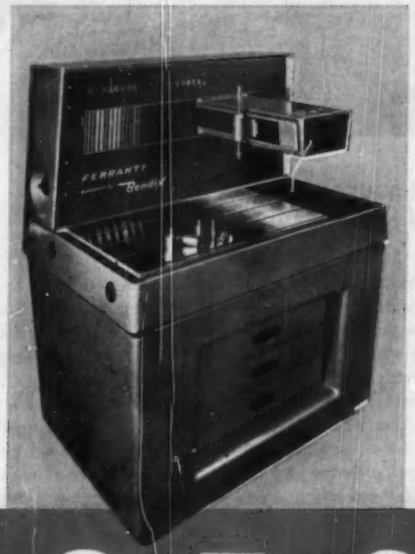
INSPECTION BREAKTHROUGH!

BENDIX ANNOUNCES New Coordinate Machine that inspects work pieces up to 10 times faster

The Bendix Industrial Controls Section and Ferranti, Ltd. have teamed up to bring the American metalworking industry a new concept in two-dimensional inspection equipment.

The revolutionary FI-22 coordinate measuring machine provides direct and continuous readout of hole center locations with one-set-up simplicity and with 0.001" accuracy over its entire 15" x 24" range.

Operator errors due to misuse or misreading of inspection instruments are essentially eliminated—one inspector can do the work of several with the help of the transistorized counting circuits and advanced mechanical design of the FI-22.



14·350+

Readout display numbers shown here are actual size.

The FI-22 features such other advantages as:

Large readout display—one set for each axis—little chance to misread these bright, ¾-inch digits.

Floating zero—set up at any point—measure in any direction.

Doubles as layout machine—for still further time savings.

Interchangeable probe tips—inspect any hole or surface location.

Backed by complete Bendix service and customer training programs. For additional information, contact us today.

Industrial Controls Section
21820 Wyoming, Detroit 37, Michigan

THE Bendix CORPORATION

ANOTHER TALIDE CASE HISTORY . . .

Talide® Dies Cut Maintenance Costs at REVERE COPPER!

REVERE COPPER & BRASS, INC., ROME, NEW YORK, producers of copper clad, stainless steel kitchenware

found aluminum bronze dies gave better production than steel alloy dies, but maintenance costs still remained high. Over 500,000 one-quart sauce pan bodies were being drawn with each aluminum bronze die costing $250, but it cost another $900 to maintain the die in operation.

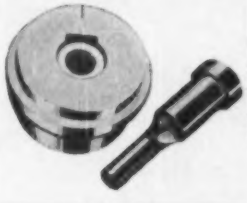
It was necessary to hand polish the die in the press every 2,000 pieces. After each 10,000 piece run, the die had to be taken to the tool room to have .010 to .030 of stock removed from face to clean up. Downtime and maintenance expense was costly.

A Talide die costing $1150 was installed and production now averages over 1,000,000 pieces with no visible wear. It was only necessary to hand polish the carbide die several times during the break-in period while drawing the first 30,000 pieces, with subsequent servicing negligible. More uniform, accurate-to-size parts are produced with scoring eliminated. No subsequent buffing operation on the piece part is required.

During the past 15-year period Revere Copper has installed over 30 Talide dies on their production line—pressing to shape a broad variety of kitchenware items, including sauce pans, covers, double boilers, percolators, handles, etc. Although millions of piece parts have been drawn to date, no Talide die has yet been worn out!

WIRE DIES

Hundreds of miles of steel and non-ferrous wire—.004 to .750—drawn through TALIDE dies.



COLD EXTRUSION DIES

50 times more valves and tappets cold extruded with solid TALIDE punches and dies.

BLANKING AND FORMING DIES

70 times more paper discs blanked out with TALIDE—over hard alloy die.

CURLING ROLLERS

TALIDE curling rolls last 65 times longer than steel rolls on beverage can forming operation.

SWAGING DIES

Leading fountain pen manufacturer cold swages 33 times more stainless steel parts with TALIDE dies.

HEADING AND EXTRUSION DIES

Cold heading ¼" C-1008 rivets, TALIDE dies produced 11,200,000 pieces, other carbide dies only 3,500,000.

POWDERED METALLURGY DIES

Compacting highly abrasive chemical powders, TALIDE pill dies last 4 months; steel dies wore out in 6 hours.

A Talide die engineer can help you cut costs and increase production on draw presses, punch presses, pill presses, cold headers, swagers and draw benches.

METAL CARBIDES CORP.
6001 Southern Boulevard
Youngstown 12, Ohio

Send for 68-Page Catalog 59-G

METAL CARBIDES CORPORATION
MC
TALIDE®
YOUNGSTOWN 12, OHIO

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

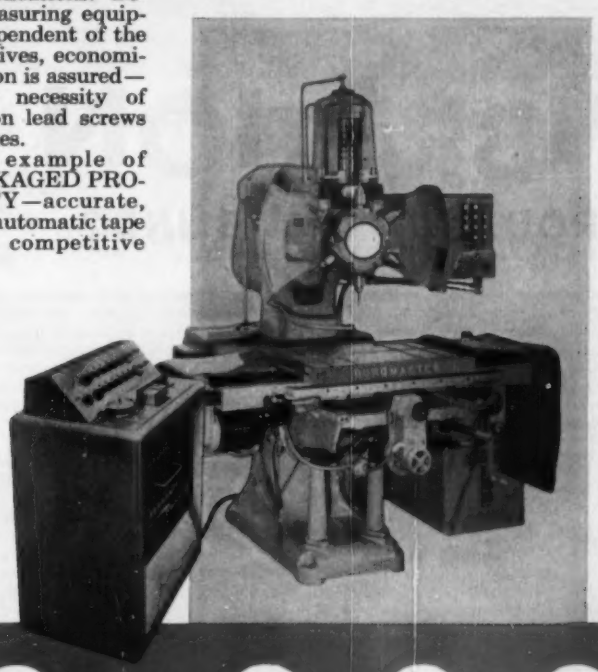
POSITIONING BREAKTHROUGH!

BENDIX ANNOUNCES Numerical Control System for point-to-point work

Long a leader in the numerical contouring field, Bendix has acquired exclusive U. S. sales and service rights on the Ferranti FP-22 numerical POSITIONING control system for machine tools.

The FP-22 is truly the practical answer to the positioning requirements of jig borers, drilling machines, punch presses and other point-to-point applications. Because its measuring equipment is independent of the machine's drives, economical installation is assured—without the necessity of ultra-precision lead screws and gear boxes.

Another example of Bendix PACKAGED PRODUCTIVITY—accurate, dependable, automatic tape control for competitive efficiency.



Position display numbers shown here are actual size.

Outstanding features of the Ferranti FP-22 include:

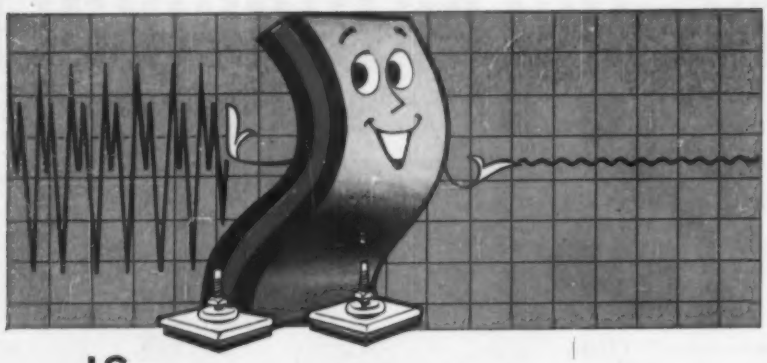
Floating zero—quick and easy set-up—low cost tooling.
Dial input—provides manual operation flexibility.
Continuous position display—available as an option.
"Accumulator" power supply—eliminates line voltage fluctuations.
Fully transistorized—requires less warm-up time—less power—less maintenance.
No contacting parts in measuring units—no wear—no eventual loss of accuracy.

Backed by complete service and customer training programs.
For additional information, contact your machine tool distributor or Bendix.

Industrial Controls Section
21820 Wyoming, Detroit 37, Michigan

THE Bendix CORPORATION

CIRCLE 274 READER SERVICE CARD



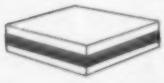
IS

VIBRATION

ROBBING YOU BLIND?

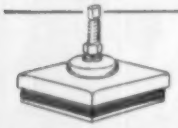
Transmitted vibration in your plant or office is a universal culprit that keeps attacking your costs and operating efficiency in a hundred ways . . . unless checked at its source.

Unisorb machine mounts — either pads or Level-Rite devices — reduce up to 85% of this transmitted vibration and provide a practical, low-cost solution to almost all vibration problems. Unisorb Vibration Control reduces noise, worker fatigue and human inefficiency. Unisorb will reduce maintenance of buildings and machines, cut down-time and simplify machine installation. In addition, tests show that Unisorb permits running machines at higher speeds and closer tolerances for increased production and improved quality.



Unisorb Mounting Pads
Unisorb pads are the basic vibration control unit, identified by the red centers and brand mark. Available in a wide range of densities and thicknesses for proper application. Saves up to 80% in installation time and costs.

Unisorb Level-Rite 200
Unisorb Level-Rite "Junior" has been especially designed for light machines, air conditioners, business machines and similar equipment. A low cost, precision leveling device and vibration control unit, with loading limit of 200 lbs. per unit. Ideal for original equipment.



Unisorb Level-Rite Mount
Unisorb Level-Rite is a universal, self-contained leveling device for all types of machines. Fast, simplified way to achieve and hold precise level. Available with exclusive screw-post design or as a basic mounting plate for use with built-in leveling devices.

Remember — to simplify installation, improve performance and control vibration . . .

UNISORB MOUNTS MAKE THE DIFFERENCE

. . . for all types of machines from laboratory equipment to giant presses.
Ask for a Money-Back Trial . . . Now!

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Company.....

Address.....

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FCO-61

Field Report . . .

Brush Beryllium's Beryllides

Completely new class of beryllium-containing engineering materials called beryllides, being developed at Brush Beryllium Co. was the topic of a two-day discussion held recently in Cleveland and attended by 70 of the nation's top metallurgists. Brush hosted the meetings which were sponsored by the Office of the Assistant Director for Aircraft Reactors, Division of Reactor Development of the Atomic Energy Commission. Meeting was arranged to exchange information between scientists doing research on beryllides in government and industrial labs. Discussions involved properties and applications of the materials which are compounds of beryllium with certain other metals. These intermetallic compounds are reported to possess an unusual combination of physical properties including strength at high temperature, oxidation resistance, low density, high thermal conductivity and nuclear cross-section.

Acme Forms English Company To Market Polishing Equipment

New company has been formed to market the complete line of Acme polishing and buffing machines in England. Named Acme-Efco Ltd, it's owned jointly by Acme Manufacturing Co of Detroit and Electro-Chemical Engineering Co Ltd of Sheerwater, Surrey, one of the leading automatic electroplating equipment manufacturers and plating process development companies in England for more than 21 years. New firm will manufacture and sell Acme units including automatic and semi-automatic polishing machines, adjustable

"Oh, oh! Looks like his tranquillizer is wearing off!"

YESTERDAY'S PIONEER . . . TODAY'S LEADER

NEW! WELDON

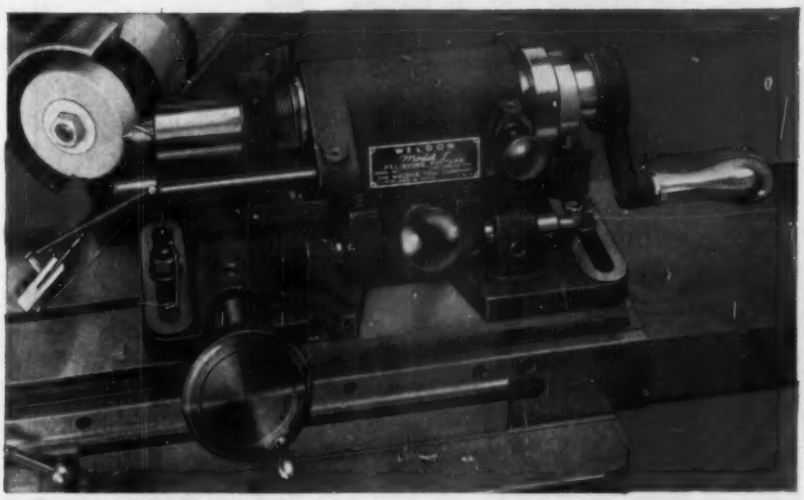
Model ∫ RELIEVING FIXTURE

For Sharpening ∫ Point Drills and other End Cutting Tools

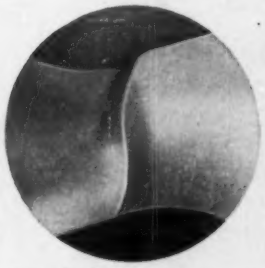
CAPACITY—3/32" TO 3/4" DIA. INCLUSIVE

TAKE ADVANTAGE OF THESE FEATURES OF ∫ POINT DRILLS

- ✻ SELF-CENTERING
- ✻ LONGER TOOL LIFE
- ✻ GREATER ACCURACY
- ✻ FINER FINISH



PATENT APPLIED FOR



SHOWING MAGNIFIED VIEWS OF THE ∫ POINT GROUND ON WELDON MODEL ∫ RELIEVING FIXTURE

IN ADDITION TO DRILL POINTING, THE WELDON MODEL ∫ RELIEVING FIXTURE IS IDEALLY SUITED FOR SHARPENING OTHER TYPES OF CUTTING TOOLS SUCH AS:

TAPS

WELDON COUNTERSINKS AND DEBURRING TOOLS

STEP TOOLS, ETC.

SEND FOR DETAILED INFORMATION:
WELDON DISTRIBUTORS THROUGHOUT U.S.A. AND CANADA CARRY COMPLETE STOCKS TO SERVE YOU

OVER 40 YEARS OF LEADERSHIP SINCE 1918

THE WELDON TOOL COMPANY

3000 WOODHILL ROAD · · · CLEVELAND 4, OHIO

Field Report . . .

buffing and polishing lathes, deburring machines, and special purpose finishing machines.

This is the second European company formed by Acme in the last five years. A German subsidiary, established in 1955 in the Frankfort area, makes Acme equipment for marketing on the continent.

$3 Million Order to Martin

Martin Co has a contract to build an electronic system for coordination of American missile defenses. Work will be done at the company's Orlando, Fla, plant. New system will be patterned after the Martin-developed Missile Master and will be located near key military installations and cities throughout the country.

General Mills Acquires Two Electronics Firms

Business of the Daven Co, Livingston, NJ, and Laible Manufacturing Co, Manchester, NH, has been acquired by General Mills, Minneapolis. Daven, with 650 employees, is a supplier of components to the electronics industry. Laible, with 600 workers, is engaged chiefly in manufacture of resistors and other subassemblies for Daven. Acquisition will be operated as a GM subsidiary under the name of Daven Co with Laible as a Daven division. Both businesses will continue to operate at their present locations.

R A Wilson, GM vice president and general manager of its Mechanical Division, will head the new company. Mr Wilson is also president of Magnaflux Corp, Chicago, acquired last fall by General Mills. Acquisitions, coupled with the Mechanical Division in Minneapolis, form a group of operating units with capabilities in the fields of electronics, computer systems, missiles, aircraft, nuclear equipment, and industrial products. Employees engaged in these activities now number nearly 3600 and annual sales are expected to top $40 million.

American Pulley Co. . . .

. . . And its Hubbard Spool Division, is now formally merged into Van Norman Industries. AP, founded in 1895 is a pioneer in the power transmission industry and also manufactures a wide line of material building equipment. Hubbard makes spools and reels for the wire industry.

BURNERD MEEHANITE Precision Chucks

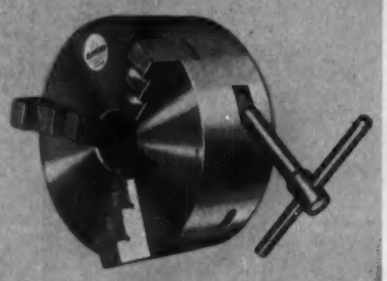
Unsurpassed in quality, precision and value!

When you buy Burnerd, you buy the best—in precision, service life and value.

Every Burnerd chuck is built to uncompromisingly high standards of accuracy. Every Burnerd chuck is *guaranteed* against defects in material and workmanship *for a period of two years*. Every Burnerd chuck is backed by the coast-to-coast sales and service organization of Clausing.

Check the wide variety of types and sizes against your requirements. Then write for a catalog and check prices—you'll be pleasantly surprised. When you invest in a Burnerd you save 20—even 30%! You get *more . . . far more . . .* with Burnerd.

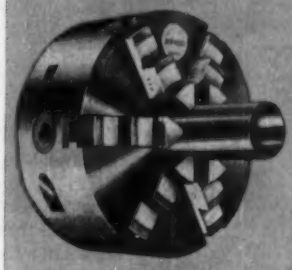
Send for literature today.



3- and 6-jaw GRIPTRU chucks

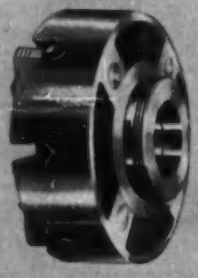
4" to 12" dia.

Concentricity within .0002" TIR!



Chucking work to within .0002" precision takes but one minute. Duplicate parts are chucked to same accuracy at scroll chuck speed. Meehanite bodies. *3-pinions.* Two sets solid jaws.

Available for direct mounting to long taper or D-1 camlock spindles, or, for backplate mounting.

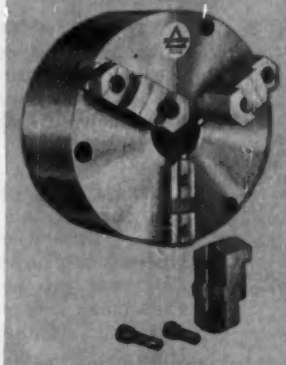


4-jaw heavy-duty independent chucks

6½" to 28" dia.

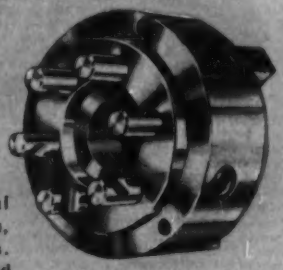
Have rugged Meehanite bodies, case-hardened ground steel jaws, large diameter case-hardened operating screws. Chucks 10" and larger have double thrust bearings.

Available for direct mounting to long taper or D-1 camlock spindles, or, for backplate mounting.



3- and 4-jaw universal chucks

4" to 24" dia.



3- and 4-jaw universal chucks, like Burnerd Griptru, have Meehanite bodies. Scrolls are precision machined from heat-treated alloy steel. Pinions are case-hardened nickel steel—*there are three in each chuck.* Jaws are case-hardened, ground.

3-jaw chucks available with two-piece jaws or two sets of solid jaws—for direct mounting to long taper or D-1 cam-lock spindles, or, for backplate mounting.

336

BURNERD CHUCKS

CLAUSING DIVISION

ATLAS PRESS COMPANY

6-202 N. PITCHER ST. • KALAMAZOO, MICH.

the special meaning

of **BAIRD**

In the machine tool business there's a saying that you're in real trouble when you begin to take the quality and performance of your machinery or tooling for granted. It's simply impossible to stand pat on a design merely because the bugs have been ironed out and the customers seem happy.

76H CHUCKER

It's more than just a natural concern about competition that keeps the Baird design group looking for the better way. Although a good deal of our engineering effort is applied to specific customer tooling requirements, the bulk of our time is devoted to continual reviews of our current machinery line and ways to improve it.

Transfer Press

Take our Chucker, for instance. The new 78-H, 8-spindle automatic incorporates a universal cross-slide that's absolutely unique. We have a brand new inclinable Four-Slide unit on the market that is probably the most versatile machine of its type available. The Model 00 four-slide unit has a new vertical swing bed that's sure to save time and work for the operator. Several new attachments for our Transfer Press have opened tremendous new fields of application, eliminating complicated and expensive secondary operations.

The special meaning of Baird? To those of us in Design, it's the ever-present urge never to leave well enough alone. There is always a better way to do it and it's up to Baird to find it.

BURTON F. LEWIS

Burton F. Lewis

BAIRD

THE BAIRD MACHINE COMPANY

1100 Stratford Avenue, Stratford, Conn.

Northfield Sets Up New Division

Northfield Precision Instrument Corp has established a Gear Manufacturing Division to produce Class 3 precision spur, pinion, and helical gears up to 4½ in. in diameter in all types of materials. New facility will be maintained for the present at the Island Park, NY, headquarters.

MEMOS

by BESS RITTER

A blind man was one of the first inventors of a practical typewriter. He was a Frenchman, named Pierre Foucault, and his machine, which was built in 1849, embossed the letters on the paper so that blind persons could read them, via touch. This, however, wasn't the first typing machine invented, for the idea was introduced to the public approximately 200 years ago:

Henry Mill, of England, suggested a machine that could print letters via type by pressing down on different keys. This was in 1714, and it isn't known whether a model was actually built.

Although it is generally supposed that the fountain pen is a fairly modern little mechanical device, it was actually invented more than 170 years ago. Its originator was a Frenchman named Coulon de Thévenot, and he called his brain child a "pen without end." It is minutely described in a periodical called "Moniteur Universel" in its issue of December 3, 1790, where the pen is declared to be capable of writing for several hours without having to be refilled.

It is recommended as a useful accessory for note taking at public meetings, and as also being valuable for persons who are travelling. Such a pen was made of either ebony or ivory, and was sold in a kit which included a bottle of ink and a set of six pens. The whole outfit was considered to be reasonably cheap—it could be purchased by anyone for six French livres.

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

MACHINES AND ATTACHMENTS

1 SINGLE ACTING PRESSES—*Niagara Machine & Tool Works, 683 Nostrand Ave, Buffalo 11, NY.* 4-page bulletin 85 pictures and describes new line of 28 models built around four basic press sizes from ½ to 2-ton capacities at 85 psi. With six optional air and electrical control systems available, choice of machines is offered for punching, swaging, staking, upsetting, and imprinting operations, as well as seating and removal of close tolerance bearings and bushings.

2 PRESS ROOM EQUIPMENT—*US Tool Co, Ampere, NJ.* 22-page illustrated bulletin 85-60 provides information on range of automatic equipment including slide feeds, roll feeds, straighteners, stock reels, coil cradles, Multi-Stops, and scrap choppers. Specifications and construction features given for each.

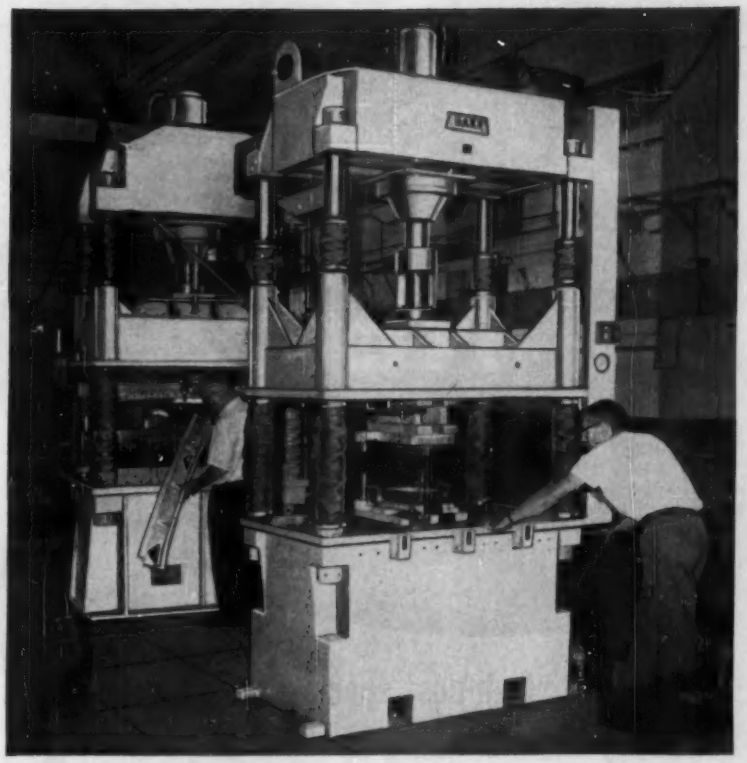
3 SWEDISH GV METAL WORKER—*Homestrand Machine Tool Corp, 392 W Putnam Ave, Greenwich, Conn.* 6-page bulletin gives data on plate and sheet working machines. Illustrates and describes five sizes with capacities from 5/64 to 5/16 in. Standard tooling listed for straight cutting, beading, circle cutting, and folding; optional tooling is available for figure cutting, slot cutting, planishing, louver forming, nibbling, and flanging.

4 "TEN MUSTS OF A JIG BORER"—*Moore Special Tool Co, 300 Union Ave, Bridgeport 2, Conn.* 4-page folder is a check list of ten vital factors to be considered by prospective purchasers. Attributes illustrated and described include linear and geometric accuracy; fast settings, tool changes, and spindle speed changes; rugged design for heavy cuts; sensitivity for small holes; simplicity of operation; inclusion of full line of cutting tools and hole-location accessories.

5 STANDARD SLIDE ASSEMBLIES—*Russell T Gilman Inc, 623 Beech St, Grafton, Wis.* 24-page catalog 1000 is a technical manual providing all data necessary for designing Gilman standard assemblies into special or semi-special production equipment for straight-line precision movements. Dimensional and operating information is furnished on nine major types of slide assemblies available in 123 standard models and sizes. Stroke lengths range from ¾ to 8 in. and table areas from 2 x 3 in. to 8 x 24 in.

"I'll tell you what a nice guy like me is doing in a dump like this—I own this dump!"

Two DAKE DIE TRYOUT PRESSES in Custom Die Shop?



Greenville Tool & Die Company, Greenville, Michigan, purchased a 150-ton Dake Hydraulic Die Tryout Press to relieve the workload on their mechanical facilities. After delivery, management discovered that the backlog of work for the Dake press was far greater than it was for the mechanical presses. Its smooth, accurate operation enabled it to easily handle presswork that would otherwise be difficult or impossible. A second Dake Hydraulic Die Tryout Press was installed because no other press could do as much work so well.

The Dake Die Tryout Presses can be stopped and reversed at any point in the stroke—diemakers can see just when and why blanks are "dragging" or "tearing," and their large daylight area allows the die to be "barbered" without removing it from the press.

At the Greenville Tool & Die Company, Dake presses are also used to align punches, "shear-in" irregularly shaped surfaces, develop blank sizes and shapes, find the right redraw depths, and even straighten heat-treated die parts.

Dake Die Tryout Presses are available in 9 standard models from 25-ton to 300-ton capacity, and in custom engineered models to 600-ton capacity to meet special requirements. Send for Bulletin No. 330.

DAKE CORPORATION, 636 Robbins Road, Grand Haven, Michigan

DAKE PRESSES

Arbor Presses | Hand-Operated Hydraulic | Power-Operated Hydraulic | Guided Platen | Gap Type Presses | Movable Frame

Eliminate "high-cost specials" by standardizing on

AMERICAN STOCK GEARS

Investigate and you'll probably find that instead of having to go to the added time and expense of ordering special gears, that your needs can be filled from the American line.

American is a 'complete' stock gear line. Manufactured by Perfection – a veteran of over 30 years in the gear business – these gears are made to the most precise standards, from the highest quality materials. This popular line includes brass, bronze, steel, semi-steel, cast iron, and non-metallic gears in a range of 48 to 3 diametral pitch.

You'll save time and money . . . save on inventory . . . simplify purchasing and have less lost production time by procuring your stock gear needs from your nearby distributor of American Stock Gears.

Ask for FREE copy of American Stock Gear Catalog No. 360 containing detailed information and engineering data.

AMERICAN STOCK GEAR division

Perfection Gear Co., Harvey, Illinois

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

TOOLS AND ACCESSORIES

6 INTERNAL GRINDING WHEELS —*Cincinnati Milling Products Division, Cincinnati Milling Machine Co, Cincinnati 9, Ohio.* 4-page booklet PG-354 illustrates and describes features which include positive duplication (PD), cool cutting, and minimum dressing. Includes table of suggested gradings for internal grinding operations and several helpful rules of thumb to be kept in mind.

7 "HOW TO READ A MICROMETER" —*J T Slocomb Co., 68 Matson Hill Rd, South Glastonbury, Conn.* Illustrated literature describes micrometer's principle of operations, how to read gradations and caliper on a conventional mike from thousandths to ten-thousandths of an inch. Instructions on how to read a Speedmike (read numerically and directly like the speedmeter on an automobile) included.

8 SEQUENCE PROGRAMER — *Clippard Instrument Laboratory, 7390 Colerain Rd, Cincinnati 39, Ohio.* 2-page bulletin 360 provides illustrated data on the Minimatic Sequence Programer MSP-1 for precise timing and cycling of automated machinery or semi-automatic work functions with air or electricity. May be powered with any small geared down motor developing 10 in.-lb or more of torque, or driven directly from the machine it is controlling.

9 TOOLROOM GRINDING WHEELS —*Simonds Abrasive Co. Tacony & Fraley Sts, Philadelphia 37, Pa.* 4-page illustrated bulletin, Form ESA-272, describes wheels featuring SA Borolon, single crystal type, friable aluminum oxide abrasive for tool and cutter grinding and for horizontal surface grinding. Grain and grade recommendations are included, arranged according to standard tool steel classifications.

10 BALANCING MACHINES — *Tinius Olsen Testing Machine Co., 407 Easton Rd, Willow Grove, Pa.* 8-page bulletin (Tinius Talks, Vol 12, No 1) on Olsen-Rava Electro-Dynamic units describes two lines of balancing machines covering a wide range of applications. These include Type S for small parts from 1 oz to 22 lb, and Type D for heavier parts to 66,000 lb or more.

11 HAND TOOLS—*Owatonna Tool Co, 512 Cedar St, Owatonna, Minn.* 16-page catalog H-9 illustrates and describes wide variety including OTC wrenches,

"Apparently neither of you is familiar with the rules and regulations of the State Athletic Commission and this Company!"

One of the 20-foot continuous-cast Asarcon Ni-Vee gate stems for sluice gates at Lockport, Ill. powerhouse flood control project.

Combining corrosion resistance, exceptional structural strength, hardness, and wear resistance:

ASARCON® NI-VEE* BRONZES

The unusual strength, exceptional hardness and excellent wearability of these continuous castings of Ni-Vee copper alloys are still further increased by simple heat treatment. Asarcon Ni-Vee castings are highly qualified for rugged heavy duty service, especially where corrosion is a problem. They are available as rods, tubes, and special shapes, in lengths up to 20 feet, diameters from 13/32" to 9⅛", only 1/32" away from finished dimensions. And they are guaranteed to be free of porosity, sand inclusions, and blow holes. For further information, write to Continuous Cast Department, American Smelting and Refining Company, Barber, N. J. or Whiting, Ind.

*NI-VEE is a registered trademark of International Nickel Company.

ASARCO

AMERICAN SMELTING AND REFINING COMPANY

CONTINUOUS CAST DEPARTMENT

West Coast Distributor: Kingwell Bros., Ltd., 457 Minna Street, San Francisco, Calif. In Canada: Federated Metals Canada, Ltd., Toronto and Montreal. Distributors in many principal cities.

CIRCLE 282 READER SERVICE CARD

A NEW *"COMPACT"* HITS THE MACHINE TOOL FIELD...

THE NEW HARIG 612 SURFACE GRINDER

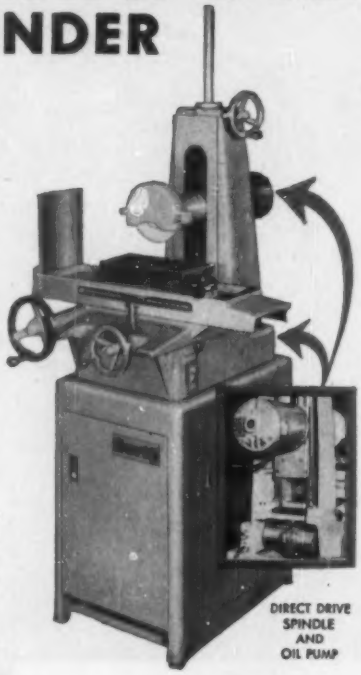
with

* **Automatic forced lubrication** goes into operation as soon as machine is started — triples life of the ways and preserves original accuracy.
* **Direct drive spindle** increases power . . . reduces vibration . . . no V-belts to replace.
* **Your choice of right or left hand longitudinal feed**

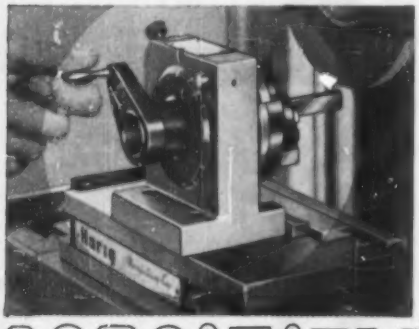
All Standard Equipment

The new 612 represents a break-thru in design and construction whereby Harig now offers industry a low-cost, precision surface grinder loaded with features usually found only on expensive models. Easy to operate . . . requires little maintenance . . . built with the precision quality you expect from Harig.

GET ALL THE FACTS . . .
Write for brochure on the Harig 612 Surface Grinder



DIRECT DRIVE SPINDLE AND OIL PUMP



WRITE FOR THE NEW GRIND-ALL BROCHURE

. . . AND HARIG'S NEW IMPROVED GRIND-ALL FIXTURE

Easily grinds irregular shaped perforators concentric with shank within ± .0001 accuracy. Also can be used for milling, boring, inspection, and radius dressing. New features include v-block adjusting screw and sine arrangement to obtain any desired angle.

WHATEVER YOUR TOOLING REQUIREMENTS . . . HARIG IS READY TO SERVE YOU!

ENGINEERING
DESIGNING
CARBIDE DIES
LAMINATION DIES
PROGRESSIVE DIES
MOLDING DIES
JIGS, FIXTURES & GAGES
SPECIAL MACHINING

HARIG SERVES ALL AMERICA

Harig Manufacturing Corp.

5743 W. Howard St. • Chicago 48, Ill.

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

pliers, cutters, punches, extensions, tool sets, tool chests, feeler gages, and miscellaneous tools.

HEAT TREATING AND WELDING

12 ELECTRON BEAM WELDING PROCESS—*Air Reduction Sales Co, 150 East 42nd St, New York 17, NY.* 12-page catalog, Form ADC-927, contains illustrated information on method which welds by direct bombardment of metal with highly accelerated electrons in a vacuum chamber. Covers all of the salient features of the process, how it operates, principal advantages, and equipment required. Includes full-page schematic drawing of the electron beam gun.

13 AUTOMATIC ARC WELDING MACHINES—*Taylor-Winfield Corp, 1048 Mahoning Ave, Warren, Ohio.* 8-page bulletin 8-513A covers 14 special, high-production units with emphasis on production rates obtainable. Shows special features for automatic operation such as mechanical loading, inspection, and automatic unloading.

14 "GRINDING WHEELS FOR THE WELDING TRADE"—*Norton Co, Worcester 6, Mass.* 15-page catalog 1724 describes each type of grinding wheel used in this field, together with its uses and properties. Photos and tables amplify text to aid the user in determining correct wheel for every job. Net price supplement included.

15 EXALENE GAS PRODUCERS — *General Electric Co, Schenectady 5, NY.* 4-page bulletin GED-3995 lists features and advantages of GE exalene (exothermic) gas producers for bright annealing, normalizing, brazing, and sintering of low-carbon steels, brass, and copper. Illustrated publication discusses burner installation, controls, cooling unit, and mixing equipment. Operating data, ratings, and dimensions included.

16 WELDING COBALT-CONTAINING ALLOYS—*Cobalt Information Center, c/o Battelle Memorial Institute, 505 King Ave, Columbus 1, Ohio.* Reprint of article from the Center's June quarterly, *Cobalt*, reviews processes and techniques for welding and brazing some cobalt-con-

"We're sending you back to engineering school for a check-up."

taining alloys. As corrosion and heat-resistant materials, the cobalt alloys resemble certain austenitic types of stainless steels; processes and techniques applicable to the welding of the latter can, with modifications, be used on the former.

17 LOW-TEMPERATURE BRAZING ALLOYS—*American Brazing Alloys Corp, PO Box 11, Pelham, NY.* 4-page folder gives analysis and comparisons of various low-temp brazing alloys. Included are low-fuming bronze; nickel silver; silver solder; Phos Sil 0, 2, 6, 6F and 15 alloys; aluminum welding wire and flux.

18 ULTRA-PURE SOLDER PREFORMS—*Accurate Specialties Co, 37-11 57th St, Woodside 77, NY.* 2-page technical data bulletin Z-103 lists compositions and melting points of 33 typical alloys available as preforms. Photo shows various shapes available including discs, washers, spheres, squares, rectangles, and split rings. These alloy preforms cover a melting range from 360 to 700 F. Lists specifications on sizes available along with tolerances.

PLANT SERVICE EQUIPMENT

19 LAPPING EQUIPMENT—*American Lap Co, 20130 Sherwood, Detroit 34, Mich.* 8-page manual and catalog gives details on lapping techniques, providing information on fast stock removal beneficial to those who lap on a production basis as well as to those whose lapping is limited to an occasional job. Cataloged are: internal helical slot expanding laps and tapered arbors; lap expanders; lap pullers; lapping plates; lapping compounds; lap and tapered arbor sets; external laps and contractable lap holders. Machines for ID, OD, and surface lapping are also described.

20 FINISHING MACHINE—*Delta Power Tool Division, Rockwell Manufacturing Co, 469 N Lexington Ave, Pittsburgh 8, Pa.* 4-page illustrated bulletin AD-1224 describes new Delta combination finishing machine with standard 4-in. abrasive belt and 12-in. abrasive disc designed for use where custom or production finishing operations must be performed economically. Machine is reported to be capable of performing 90% of all shop finishing operations.

21 SPECIFICATIONS FOR AIR CONDITIONING—*Korfund Co, 48-39B 32nd Pl, Long Island City 1, NY.* 6-page bulletin F2D is a complete guide to writing vibration and noise control specifications for air conditioning and related equipment. Discusses factors involved in selection of various resilient mountings with particular attention to effects of existing job conditions—critical, extremely critical, and non-critical conditions. Photos show exact type of vibration control mounting to use for each problem.

22 AXIAL PISTON PUMPS—*Denison Engineering Division, American Brake Shoe Co, 1160 Dublin Rd, Columbus, Ohio.* 8-page bulletin 203 covers use of pumps at pressures up to 5000 psi. Discusses company's 30, 40, and 60 Series in both constant and variable volume models. Performance and torque curves illustrated as well as complete schematics which show the axial piston techniques of pumping. Ratings chart for both pumps and fluid motors, ranging in maximum pressures from 3500 to 5000 psi included.

23 VIBRASHEEN MACHINES—*Almco, Queens Products Division, King-Seeley Corp, Albert Lea, Minn.* Catalog describes, pictures, and provides technical information on seven vibratory machines providing tub capacities ranging from ¾ gal to 12 cu-ft capacity. Illustrates variety of parts before and after finishing with Almco machines and methods.

24 PLASTIC BLISTER PACKAGING MACHINE — *Sundstrand Machine Tool, Division of Sundstrand Corp, Belvidere, Ill.* 4-page bulletin illustrates and

The Gage of PERFECTION...
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Hanson-Whitney Gages measure up to the most exacting requirements with precision that assures positive thread gaging accuracy. Long-wearing qualities characterize the complete line.

Also available is a complete line of Internal and External Thread Comparators of the same precise and reliable excellence.

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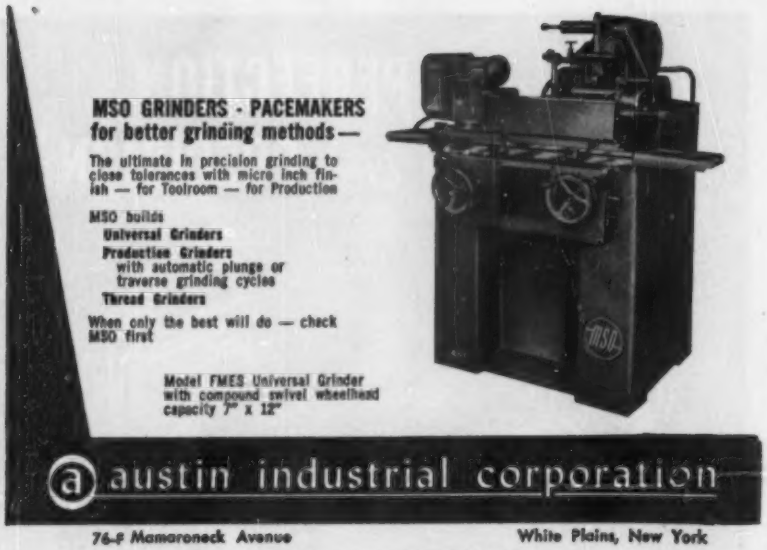
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The ultimate in precision grinding to close tolerances with micro inch finish — for Toolroom — for Production
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Production Grinders with automatic plunge or traverse grinding cycles
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When only the best will do — check MSO first
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Table size 33½" x 18½"
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Boring depth 12"
Net Weight — 7500 lbs.
The ULTIMATE in
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ease
Setting accuracy .00002" Positioning accuracy .00012"
Select any point as starting point. "Zero-in" scales by push button. Read scales to millionths without leaving operator's position.
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White Plains, New York

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

describes the Model 58 Packmaster that packages products from 1½ to 6 in. in length and 1½ to 6 in. wide at speeds of 0-300 ipm.

PARTS AND MATERIALS

25 VARIABLE SPEED DRIVES — *—Link-Belt Co, Prudential Plaza, Chicago 1, Ill.* 6-page folder 2874 illustrates and describes Type RS PIV constant horsepower drives designed to meet capacity demands up to 50 hp and ratios up to 5.5:1. Applications include precise speed control for heavy machine tools, timing, mixing, synchronizing, conveying, and handling systems. Pictures types of assemblies and sizes available, speed variation ratios, and selection data.

26 MAGNESIUM — *Dow Metal Products Co, Midland, Mich.* 6-page illustrated brochure discusses characteristics of the metal including excellent machinability; ability to be formed by almost every forming method known; and high weldability.

27 STEEL—*Fisher Bros Steel Corp, Nordhoff Pl, Englewood, NJ.* 1960 catalog, pocket-size designed for calculating steel requirements includes technical data together with complete listing of carbon and stainless steel forms, weights, sizes, shapes, and finishes.

28 TUBE FITTINGS—*Lenz Co, 3201 Klepinger Rd, Dayton 1, Ohio.* 118-page illustrated catalog of original equipment and replacement tube fittings, featuring the Lenz-O-Ring Seal fittings, contains an illustrated index for quick reference. Each specification table is coupled with cutaway drawing with all dimensions letter-keyed to specifications and dimensions in the table.

29 FLUID DRIVES—*American-Standard Industrial Division, Detroit 32, Mich.* 20-page illustrated bulletin A-719 describes Class 4 line of adjustable speed Gyrol fluid drives. Discusses principles of operation and shows typical applications. Includes selective guide charts for both variable torque and constant torque applications; dimensional data in tabular form; itemized listing of the data to furnish when placing orders for fluid drives.

30 FASTENERS FOR ELEVATED TEMP SERVICE — *Mercury Air Parts Co, 9310 W Jefferson Blvd, Culver City, Calif*—12-page engineering data catalog 286 covers bolts, nuts, screws, and dowels fabricated to AMS 5735 for 1300 to 1800 F applications.

31 ELECTRIC CLUTCHES AND BRAKES—*Simplatrol Products Corp, 24 Salisbury St, Worcester, Mass.* 6-page brochure presents illustrated descriptions of more than 20 types of fixed field, miniature, small, and larger electric clutches and brakes for a wide variety of design applications. Various sizes of each type are listed together with pertinent data on rated static torque and coil power watts. Conversion table and clutch brake selection data section provided.

32 FASTENERS—*Standard Screw Co, 2702 Washington Blvd, Bellwood, Ill.* 6-page brochure contains dimensional data, photos, and drawings on Stanscrew hex and hex screws, carriage bolts, and lag screws.

33 SLIDING GATE PRESSURE REGULATORS — *OPW-Jordan, 6013 Wiehe Rd, Cincinnati 13, Ohio.* 8-page catalog J160-1 covers complete line of self-operated, pilot-operated, solenoid-operated, and back-pressure regulators designed for

use on steam, water, air, oil, gas, or corrosive chemicals. Describes applications of each of the four basic types, tells how each works. Includes cutaway drawings, sizing charts, flow curve, sample specifications, and complete engineering information.

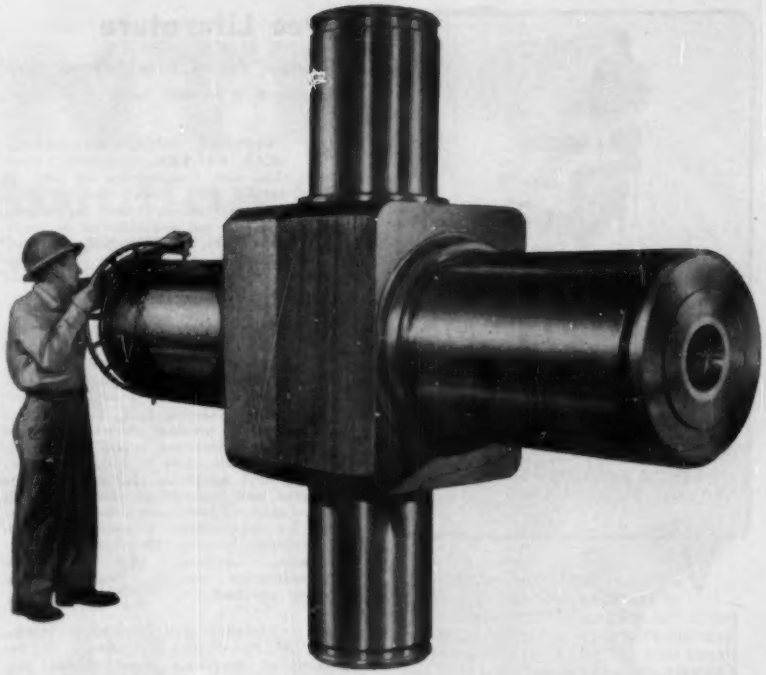
34 CYLINDER TRACING TEMPLETS —*Control Equipment Line, 19560 Center Ridge Rd, Cleveland 16, Ohio.* 16-page Form 360 contains full-size tracing templets of a complete line of small size cylinders for both OEM and in-plant use. Designer or draftsman can trace the exact mounting style, bore, and stroke he wishes to use. Cylinders covered come in two series, medium pressure (200 psi air or 750 psi oil) and high pressure (2000 psi oil). Capacity chart lists push and pull forces at various pressures for the three bore sizes, ¾, 1, and 1½ in.

35 STAINLESS STEEL WIRE MANUAL—*Jones & Laughlin Steel Corp, Stainless & Strip Division, Box 4606, Detroit 34, Mich.* 22-page illustrated booklet contains technical data and practical information on use and ordering. Includes data on chemical analyses and mechanical properties of all grades of stainless steel used in wire, and recommendations for application of representative grades in some 400 corrosive environments.

36 FILTRATION PRODUCTS—*Purolator Products Inc, Dept. 135, Rahway, NJ.* 18-page booklet IND-1-60 gives information on filter media for a variety of applications including machine tool coolants, hydraulic fluids, internal combustion engines. Covers explanation of flow rate, degree of filtration, viscosity of fluids, and reliability of specific media. Operating specifications given for range of filtration, temperature limits, flow characteristics, and typical applications and assemblies are used to illustrate ranges.

37 HEAT-RESISTANT CAST HIGH ALLOYS—*Alloy Casting Institute, 1001 Franklin Ave, Garden City, NY.* 12-page article on factors involved in selecting such castings for applications where temperatures exceed 1200 F separates the 14 ACI cast grades available for high-temp service into three groups according to their chromium and nickel content. Presents five major considerations in selecting a heat resistant cast alloy: surface stability, structural stability, mechanical properties, physical properties, and design considerations.

"I heard you just moved into the foreman's neighborhood, Al. What are you—a status seeker or something?"



13½ TON EQUALIZING AXLE from BLUEPRINT to FINISHED PART by FINKL

This 27,000 pound steel forging,* made to support a million pound load, was completely manufactured from molten steel to a finished machined part in the Finkl shops.

A 115,000 pound electric furnace steel ingot was cast, forged, hot cut and heat treated, followed by hundreds of hours of rough and finished machining. Then the square section was heated to accept the horizontal part to complete the shrinking operation to make this equalizing axle.

Finkl is well-equipped to engineer and produce a wide range of forged parts . . . our sales engineers will be pleased to talk to you about your forgings, hot work steels and die block needs.

*Replaced a casting

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largest forgings in the Middle West

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"WITH LUBRIPLATE LUBRICANTS—NO BEARING LOSS FOR AN ENTIRE SEASON"

so states a well-known manufacturer of Cotton Gin and Oil Mill Machinery

"We have gone to great expense in checking lubricating greases out in the field and find the best to be LUBRIPLATE. Over a season's test we found that out of all the greases tried LUBRIPLATE was the only one that did stand up under all operating conditions throughout a season's run without loss of a single bearing."

REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE GREASE AND FLUID TYPE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE COSTS.

LUBRIPLATE is available in grease and fluid densities for every purpose . . . LUBRIPLATE H. D. S. MOTOR OIL meets today's exacting requirements for gasoline and diesel engines.

For nearest LUBRIPLATE distributor see Classified Telephone Directory. Send for free "LUBRIPLATE DATA BOOK" . . . a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

38 CYLINDER OPERATED SHEAR-SEAL VALVES—*Barksdale Valves, 5125 Alcoa Ave, Los Angeles 58, Calif.* 8-page catalog COV 60-61 contains illustrated data on valves rated for 10,000, 6000, and 3000 psi hydraulic oil or water and 10,000, 4000, and 2000 psi air. They are available in 4-way, 3-way, and shut-off flow patterns. Port sizes range from ¼ through 1½ in. NPT.

39 PERMANENT MAGNETS — *Indiana Steel Products, Division of Indiana General Corp, Valparaiso, Ind.* New catalogs covering the entire line of Indox ceramic magnets provide complete information on Indox I, V, and VI, and supersede all previous Indox literature. Catalog 18A describes special properties, uses, and applications of Indox I and V. Typical and minimum characteristics are graphed and summarized. Selector chart, list of stock magnets, and a de-rating curve for low temperature operation included. Engineering bulletin 353 covers Indox VI. Magnetic, material, and temperature characteristics covered; demagnetization curves provided.

40 CLIMELT MOLYBDENUM PRODUCTS—*Climax Molybdenum Co, Division of American Metal Climax Inc, 1270 Avenue of the Americas, New York 20, NY.* 24-page booklet gives full details on various sizes, forms, conditions of use, tolerances, weights, and methods of identification. Materials, Climelt molybdenum metal and three molybdenum-base alloys, are made by the arc-cast process which gives forgeable products of various shapes for industrial fabrication into finished parts. Properties include great structural strength at elevated temperatures, high melting point, exceptional thermal-shock resistance, and good electrical conductivity.

41 O-RINGS—*Parker Seal Co, 10567 Jefferson Blvd, Culver City, Calif.* 24-page handbook 5711 covering Viton O-Rings as high temperature seals contains test information on some 150 fluids and gases with which they are compatible; recommended O-Ring and groove design techniques; data on three Viton O-Ring compounds and dimensions; and data on all ARP (AN) standard O-Ring sizes.

42 HYDRO - T-METAL — *Whitehead Metals Inc, 303 W 10th St, New York 14, NY.* Brochure describes new, lowcost metal that is said to feature extreme strength. An alloy of zinc, copper, and titanium, it retains the basic advantages of zinc yet provides the structural strength, stability, and scope of other nonferrous metals. Advantages: It solders easily, can be fusion welded, deep drawn without work hardening or annealing, takes nickel and chrome plating, has excellent resistance to corrosion, is easily color coated, has non-magnetic and non-sparking characteristics.

MISCELLANEOUS

43 "AUTOMATION AND YOU"—*General Electric Co. Schenectady 5, NY.* 16-page bulletin GED-3908 assesses the current state of automation, summarizes the need for and economic benefits of automation, and provides information for management on six key functions of automation: process control, computing, instrumentation, numerical control of machines, sensing, and communications. GE products, facilities, and engineering capabilities are discussed as they apply to automation of industrial and commercial processes, and the company's "Automation Ring" concept—a philosophy of planned, progressive automation — is interpreted from the management point of view.

44 ANALYSES SERVICES AND QUALITY CONTROL — *Spectrochemical Laboratories Inc, PO Box 8781, Pittsburgh 21, Pa.* 12-page brochure pictures and describes facilities for analysis of metals, ceramics, and miscellaneous products such as welding rod coatings, chemicals, and corrosion products.

● "MAKE OR BUY" STUDY—*National Screw Machine Products Association, NSMPA Bldg, 2860 E 130th St, Cleveland 20, Ohio.* Report is designed to aid companies in determining the economic feasibility of maintaining their own screw machine departments, whether such companies now have their own departments or are purchasing screw machine products from independent producers. Subjects covered include personnel factors, capital investment and finance, department operations, and other data to be applied against a company's existing operations and costs. Case histories included. Request direct on company letterhead.

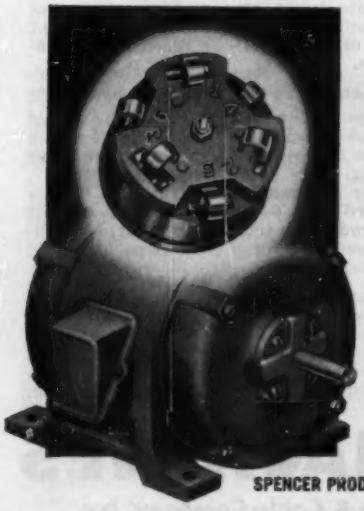
45 PROS AND CONS OF LEASING—*Foundation for Management Research, 121 W Adams St, Chicago 3, Ill.* Third edition of study on equipment leasing for smaller manufacturers has been revised and expanded to 24 pages. New section covers discussion of renewals and options-to-buy at end of lease period, and an examination of latest Internal Revenue Service rulings with regard to write-offs of payments on leased equipment.

46 DROP FORGINGS—*Union Forging Co, 500 North St, Endicott, NY.* 16-page illustrated brochure discusses diversified design, engineering, and processing services available in the production, machining, coining and finishing of ferrous forgings for the automotive, aircraft, and farm machinery industries. Includes case histories, step-by-step production illustrations, and information on improved techniques and approaches in product development.

HUNTING

for a Solution to STOP MOTOR BURNOUTS

Specify and use 3-phase motors with built-in KLIXON PROTECTORS



SPENCER PRODUCTS

RESULT . . . • *Eliminate Motor Burnouts* • *Get Maximum Motor Output* • *Reduce Costly Equipment Down Time*

No matter what the motor application . . . whether it be textile looms or turret lathes . . . ventilating fans or rolling mills . . . built-in KLIXON Protectors keep motors from burning out under all conditions that cause overheating.

Built-in by the motor manufacturer, as an inherent part, KLIXON Protectors are matched to the thermal characteristics of the motor providing a tested and proven combination to assure full protection. KLIXON Protectors safeguard motors and prevent burnouts caused by the following conditions . . . prolonged overloads, unbalanced voltage, stalling, failure to start, increased ambient temperatures, lack of ventilation, plugging, or reversing duty, and single phasing.

And remember, get the same complete protection in your single phase motors, too.

KLIXON protected motors are available from your motor supplier. The additional cost is low, the savings great. Ask your motor supplier for KLIXON protected motors.

Write for a free copy of Bulletin PR-1243. It gives the complete story.

TEXAS INSTRUMENTS
INCORPORATED
METALS & CONTROLS DIVISION
5602 FOREST STREET • ATTLEBORO, MASS.

SPENCER PRODUCTS: Klixon® Inherent Overheat Motor Protectors • Motor Starting Relays • Thermostats • Precision Switches • Circuit Breakers

With this Campbell Machine, you can--

Cut 6-inch Diameter Hard Alloys-Cleanly and Accurately-in Less Than 3 Minutes!

• This Campbell wet abrasive cutting machine—the Model 406—will cut tubing, bar stock, angle iron, or any other shape up to 6″ round or square—and it will cut practically *any* material, including the new super alloys and exotic metals. Like all Campbell machines, it's designed to give *accurate* cuts, quickly and cleanly.

HIGH SPEED—4 to 8 seconds per square inch is the normal cutting speed for all Campbell wet abrasive cutting machines. For instance, you can cut 6″ diameter hardened steel in less than 3 minutes.

ACCURACY—Campbell machines are production machine tools. They cut within close tolerances to reduce rejects and scrap loss. For example, the Model 406 will cut 3″ diameter material to lengths within ±.010″, 6″ diameter within ±.030″.

FINE FINISH—Additional finishing operations are rarely required. There is no burn, and burr has been reduced to an absolute minimum.

POWER OSCILLATION—On an oscillating-type machine such as the Model 406, the cutting wheel is moved horizontally back and forth *across* the cut as the wheel is fed downward. The result—greater cutting capacity, with longer wheel life.

PROPER COOLANT APPLICATION—Large reservoir and a 33 gallon/minute pump provide high volume of coolant. Unique Campbell distributor applies coolant equally to both sides of the wheel—an essential requirement for accurate cuts.

OTHER CAMPBELL MACHINES FOR ANY CUT-OFF NEED

Choose from four types of Campbell machines for wet or dry cutting—chop stroke, oscillating, horizontal or rotary—with capacities up to 14″ rounds, 12″ billets, plate up to 6″ thick and 20 ft. long.

Regardless of your application, you'll find that a Campbell machine provides you with the best cut-off method for modern production techniques—far more efficient, accurate and economical for cutting many materials than other cutting equipment.

WRITE FOR DETAILS—Bulletin DH-260 gives the complete story on the Campbell Model 406 abrasive cutting machine. We'll also be glad to send you information on other machines; just tell us your cut-off application. And remember—your Allison-Campbell Field Engineer is an abrasive cutting specialist. Call on him for expert advice.

ACCO

CAMPBELL ABRASIVE CUTTING MACHINES

Allison-Campbell Division • American Chain & Cable Company, Inc.

923 Connecticut Avenue, Bridgeport 2, Conn.

Onsrud Machine Works, Niles, Ill, has elected **Charles R Onsrud** president. **R F Onsrud** has been named chairman of the board, and **Miss Hjordis R Krabol** vice president and treasurer of the company

General Motors Corp has elected **Harold G Warner** (left) a vice president and appointed him general manager of **Cadillac Motor Car Division,** Detroit. Mr. Warner, who has been Cadillac works manager since 1955, succeeds **James M Roche** who has been named GM vice president in charge of the Distribution Staff. **Robert J Ackerman** (right), assistant works manager at Cadillac, has been appointed works manager there

NAMES IN THE NEWS...

Chrysler Corp has appointed **William P Balthrop** president of its Amplex Division which produces powder metal products and manufactures Oilite bearings. Mr Balthrop, previously manufacturing manager of the Trenton Engine Plant, succeeds **C J Demrick** who has resigned.

Borg-Warner Corp, Chicago, has appointed **Joseph B Elliott** president and general manager of the York Division. Formerly president of Schick Inc, he succeeds **Henry Haase** who has headed York since 1956 and is now transferred to the Borg-Warner central office.

Gisholt Machine Co, Madison, Wis, has named **Ralph J Miller Jr** district manager of the Chicago territory. Mr Miller was a direct sales representative for the Cleveland territory for 11 years before being transferred to Chicago in 1953

Walworth Co, New York, has named **Marvin H Grove** to the newly created post of chief executive officer and has also elected him chairman of its executive committee. Mr Grove is founder and president of Grove Valve & Regulator Co, Oakland, Calif, subsidiary of Walworth.

Clark Equipment Co, Buchanan, Mich, has elected **Bert E Phillips** a vice president of the company. Mr Phillips is general manager of the Industrial Truck Division at Battle Creek, Mich, and will continue to make his headquarters there.

General Electric has appointed **Harold W LeBoeuf** manager of manufacturing of the Silicone Products Department at Waterford, NY. He succeeds **Dr James R Donnalley** who has recently taken over the post of general manager of the Insulating Materials Department in Schenectady. Mr LeBoeuf was formerly plant superintendent at Waterford.

Cleveland Crane & Engineering Co, Wickliffe, Ohio, has consolidated all sales activities into one department headed by **Robert G Birkin** as general sales manager and **J G Frischkorn** as sales manager. Mr Birkin was previously manager of Heavy Machinery Division sales and Mr Frischkorn managed sales of the Cleveland Tramrail Division.

Sunbeam Equipment Corp, Meadville, Pa, has appointed **Willard Roth** assistant chief engineer for industrial furnaces and equipment. He was formerly associated with the Industrial Division of Lindberg Engineering Co, Chicago.

National Automatic Tool Co, Richmond, Ind, has appointed **Calvin Irish** manager of product engineering. He was formerly assistant chief engineer of the Machinery Division of Ex-Cell-O Corp

Brown & Sharpe Mfg Co, Providence, has appointed **Colin Sharp** director of the R&D Laboratory, Cutting Tool Division. He was formerly West Coast service manager for the company

Vickers Inc, Detroit, has elected **Gordon H Clayton** a vice president of the company. He is general manager of the Electric Products Division

ELDORADO GUN DRILL

DRILL HOLES

more economically...more efficiently, with controlled surface finish.

Drill straight, round, accurately finished holes at high speeds...through solids, blow-holes, hard spots and across-holes, in one single operation.

If you are now using gun drills, it will pay to find out how ELDORADO can cut your costs, give you improved hole finish. Chances are there's an ELDORADO Gun Drill in stock for you. Avail yourself of ELDORADO's experience and research facilities to answer your 'hole' problem.

Send for NEW LITERATURE on Gun Drills and Gun Reamers.

ORDER STOCK SIZES FOR IMMEDIATE SHIPMENT. TO SPECIFICATIONS, ON NORMAL DELIVERY.

MADE TO YOUR SPECIFICATIONS:		AVAILABLE FROM STOCK:	
Sizes	.1250" to 2" dia.	⅛" to ½" dia. in 64ths	½" to ¼" dia. in 32nds
OA Lengths	4" to 120" with dia. limits	10", 16", 22", 36"	16", 22", 36"
Drivers	Std. or to fit your need	.750" dia. x 2¼" long	1" dia. x 2¼" long
Tips	Carbide	Carbide	Carbide
Now, order from stock, or send in your specifications for a prompt quotation.			

Specializing 100% in Gun Drills and Related Tools.

ELDORADO TOOL & mfg. corp.

340 Boston Post Road • Milford, Conn.

* Trade Mark

NAMES IN THE NEWS...

Mechanical Specialties Co, Los Angeles tooling and machining firm, has named **Edward E Sigg** vice president, manufacturing. Company is one of the original group of tool and die shops in southern Calif

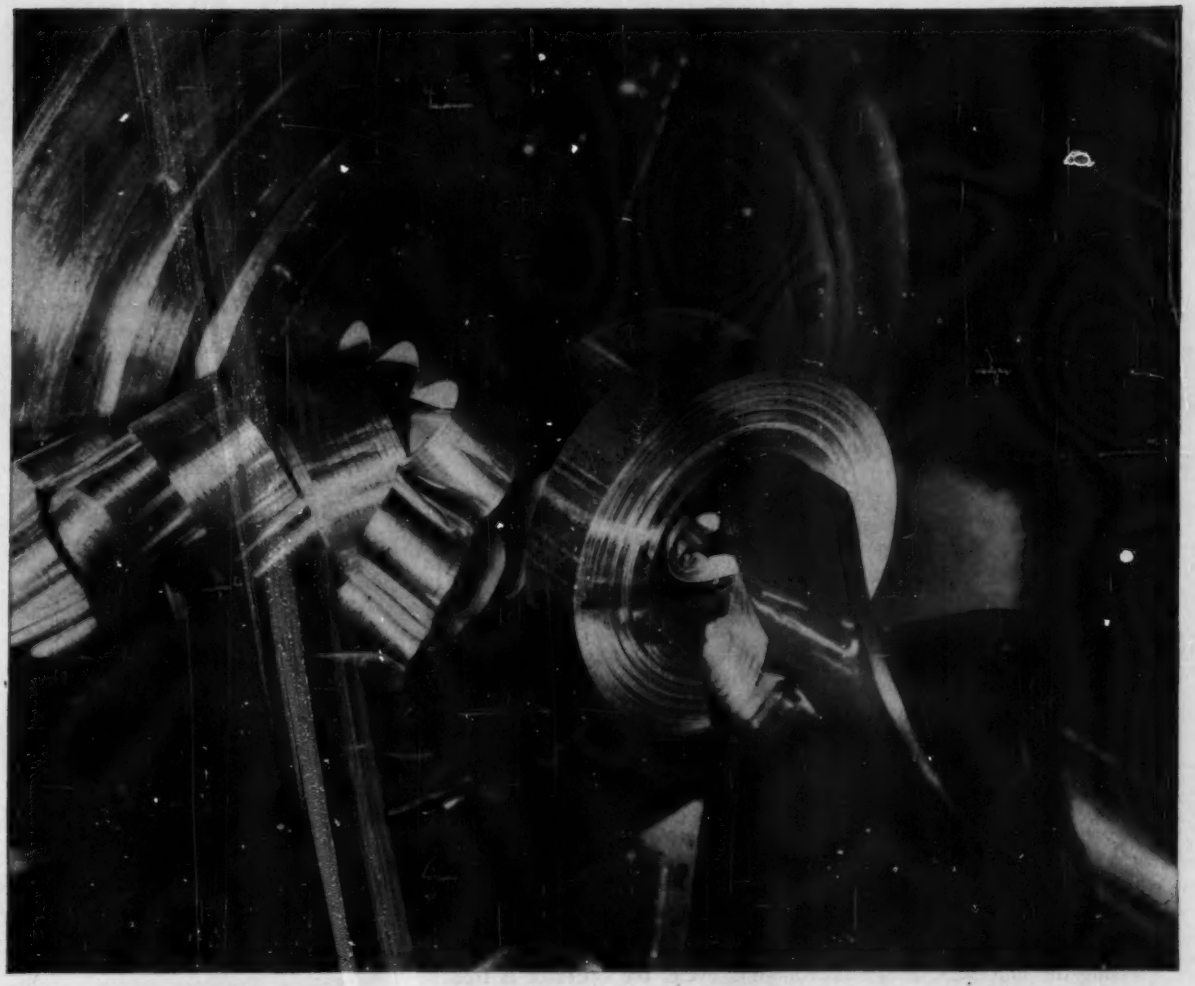
Fluid Packed Pump Co Division of the National Supply Co, Pittsburgh, has appointed **James M McFadden** general manager of the division to succeed **Sidney A Shuman** who has been transferred to Pittsburgh as assistant to the president of National Supply.

Hughes Aircraft Co has appointed **Monson H Hayes Jr** manager of its new computer laboratory at Fullerton, Calif. Mr Hayes joined Hughes last August after nine years with Link Aviation, Binghampton, NY, as vice president in charge of engineering and development.

Heppenstall Co, Pittsburgh, has appointed **Charles T Heppenstall** manager of specialty product sales. He will be responsible for the commercial phases of sales of materials handling equipment made at the company's New Brighton, Pa, plant, and of machine knives and metal-cutting knives produced in Pittsburgh. Mr Heppenstall was formerly manager of materials and production at the New Brighton plant.

Texas Tool and Die Manufacturers Association has elected as its 1960-61 president **B R Polley** of Polley Bros & Verson, Dallas. **Frank Koenig** of Aeroaffiliates Inc, Fort Worth, has been elected vice president of the Association.

Ingersoll Products Division of Borg-Warner Corp has appointed **Michael Votava** sales manager for the Emcor Ingersoll Products Division. He was formerly sales supervisor at Emcor.



Make "impossible" machining jobs easy ...with ALCOA ALLOY 6061!

• Tops in corrosion resistance!
• Superior finishing characteristics!
• Easily joined by soldering, brazing, welding!

Alcoa 6061-T6 or -T651 is the most versatile of all the aluminum standard screw machine stock alloys. This alloy is best for applications requiring joining, brazing, welding or soldering. And 6061 defies corrosion! The most highly finishable of the aluminum alloys, it is especially receptive to color anodizing.

When you use Alcoa® Aluminum Screw Machine Stock Alloy 6061-T6 or -T651, a complete package of data and on-the-spot service is available to you . . . when and where you need it! And for those other "impossible" machining jobs, look to Alcoa 2011-T3 or -T8, 2017-T4 or -T451 and 2024-T4 or -T351.

Ask your Alcoa distributor or call your nearest Alcoa sales office for more information. Get your free copy of the *Alcoa Screw Machine Stock Estimating and Operating Data Book* . . . provides complete information at your finger tips . . . helps make the toughest machining job a cinch. Ask, too, for a free copy of the handy *Alcoa Conversion Calculator* slide-rule device that quickly computes costs, shows savings in making a switch from brass to aluminum. Aluminum Company of America, 843-F Alcoa Bldg., Pittsburgh 19, Pa.

"PLUS" bonuses — when you use Alcoa Aluminum Screw Machine Stock!

1. Wide range of stock sizes.
2. Guaranteed market for up to 60 per cent of your Alcoa Aluminum turnings and borings.
3. Extensive mill and distributor inventories to cover all requirements.
4. Chamfered ends . . . at no extra cost.
5. Specific 12-ft lengths . . . at no extra cost (rounds up to 2¾ in.; hexagons up to 2 in.).

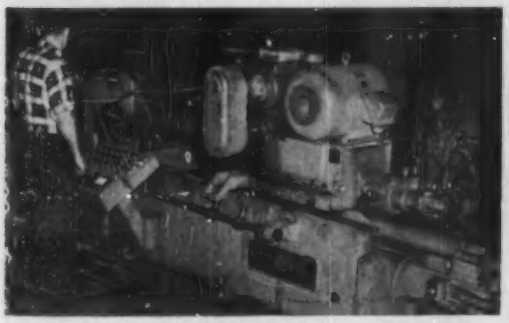
ALCOA ALUMINUM

SCREW MACHINE STOCK

For exciting drama watch "Alcoa Presents" every Tuesday, ABC-TV, and "Alcoa Theatre" alternate Mondays, NBC-TV

WHY MICROHONING* OF HARDENED LINERS cuts production time two-thirds

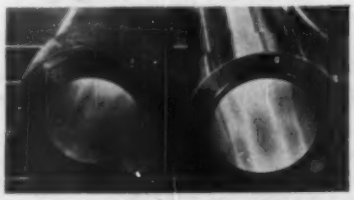
One of the largest steel corporations utilizes Microhoning's rapid stock-removal in the processing of oil well slush pump liners. Bore diameters ranging from 4.50" to 7.75" and up to 28" long are lined with a special alloy steel hardened to 64-66 Rockwell "C". Over one cubic inch of stock per minute is removed from bores of these liners to reduce required production time by two-thirds.



This heavy-duty Hydrohoner has a 4-foot hydraulic head stroke, an 8-speed transmission, a special heavy-duty feed mechanism and automatic stonewear compensation.

One heavy-duty horizontal Hydrohoner has eliminated the use of bore grinding (two grinders), and replaced two old vertical honing machines. Requiring only one operator, the Hydrohoner does the complete bore machining operation in one-third the previous time. Also, during the automatic rough-Microhoning cycle, the operator is free for an average of 20 minutes to work on an adjacent machine, where the liner O.D. is machined concentric to the Microhoned bore.

Two Microhoning operations are performed (rough and finish) to provide final bore roundness and straightness within .0005" and surface finish of 6-8 microinches (rms). An extremely hard surface having geometric accuracy and controlled finish lasts longer, provides better performance – that's why Microhoning is specified for processing these oil well slush pump liners.



Shown are rough-Microhoned and finish-Microhoned bores. Following each Microhoning operation every bore is given a close inspection under the revealing probe of a fluorescent light to insure a flawless surface.

See facing page for details on how Microhoning of pump liner bores secured production time savings.

**Registered U.S. Pat. Off.*

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

NAMES IN THE NEWS . . .

American-Standard Industrial Division, Detroit, has appointed **Paul W Wilcox** as manager of nuclear product sales. Formerly South Pacific Coast manager for all products of the Industrial Division, formed in 1959, Mr Wilcox will be responsible for coordination of sales, design, and manufacturing of products for users and manufacturers of equipment for nuclear service.

Boeing Airplane Co has named **W D Geist** sales manager for the Boeing Applied Computing Services, a new computing center established at the **Wichita Division** to specialize in numerical control and data processing services for industry and business. Mr Geist was formerly chief of equipment engineering in plant planning.

US Gasket Co, Camden, NJ, Plastics Division of Garlock Inc, has elected **Charles C Colozzi** president. Formerly plant manager, he succeeds **A J McMullen** who has resigned as USG president to devote full time as president and chief executive officer of Garlock.

American Insulator Corp, New Freedom, Pa, has appointed **John W Berthold** chief engineer. He was previously assistant chief engineer of the New Freedom custom plastic molder.

McGraw-Edison Co, Chicago, has elected **Alfred Bersted** president to succeed **Max McGraw** who founded the company in 1900 and headed it for 60 years. Mr McGraw has been named chairman of the newly formed executive committee. Mr Bersted has been in charge of the company's brand appliance business.

Sutorbilt Corp, Compton, Calif, manufacturer of blowers, gas and vacuum pumps, has appointed **Paul M Hollinger** general sales manager. Prior to joining the firm Mr Hollinger was associated for 20 years with Fuller Co, Catasauqua, Pa, in pneumatics and compressor sales engineering.

Sperry Rand Corp has appointed **William D Caffin** sales manager for motor products of its Wright Machinery Co Division at Durham, NC. Mr Caffin was formerly sales manager for electro mechanical products at Bowmar Instrument Corp, Fort Wayne, In.

Rockwell Manufacturing Co has promoted **Samuel W Brown** from assistant general manager to general manager of the Uniontown, Pa, plant.

Westinghouse Electric Corp has appointed **R C Robinson** manager of the Dover, NJ, plant which manufactures electric stairways. He moves up from the post of superintendent. **M E Hill** has been promoted from superintendent of equipment and methods to manager of manufacturing planning.

Diehl Manufacturing Co, Somerville, NJ, subsidiary of Singer Mfg Co, has appointed **Charles B Pickering** product manager of numerical control systems. He was previously sales engineer at the company's Needham, Mass, branch office.

General Electric Co has appointed **R W Hodgers Jr** manager of engineering for the X-Ray Department in Milwaukee. Associated with GE engineering projects for the past 13 years, he succeeds **M A Edwards** who has been transferred to Schenectady, NY, as manager of advanced product planning in the Electronics Component Division.

Hitemp Inc, Monrovia, Calif, has appointed **William W Crossman** manager. Company is a newly formed subsidiary of Hitemp Wires Inc, producer of high temperature insulated wire and cable. Mr Crossman was formerly manager of manufacturing in the parent company's Westbury, NY, plant.

UN Alloy Steel Corp, Boston, has named **Richard L Duncan** product manager of the company's hot work tool steel division. He will direct metallurgical research and development of new alloys as well as tooling engineering services for the extrusion industry.

Cleco Air Tools, a division of Reed Roller Bit Co, Houston, Texas, has appointed **J A Grundy** general manager. Mr Grundy will continue as vice president, operations, of the parent organization.

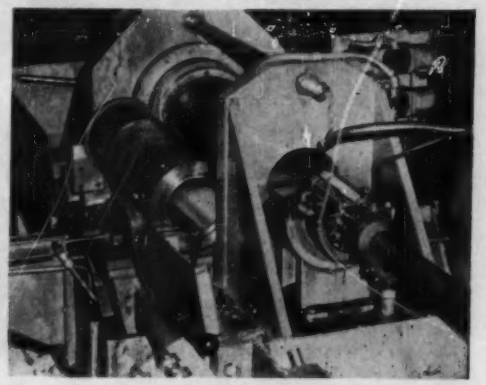
United Aircraft's Norden Division has named **Albert P Tis** operations manager of the Ketay department at Commack, Long Island, NY.

Horkey-Moore Associates, Torrance, Calif, has appointed **Harold A Price** manager of industrial products. He was previously manager of Permanent Filter Corp's Lafayette and Long Beach Divisions.

HOW MICROHONING OF HARDENED LINERS cuts production time two-thirds

Microhoning eliminates bore grinding (two grinders), replaces two old vertical honing machines with one horizontal Hydrohoner, and performs all bore machining on this one Hydrohoner in one-third of the previous processing time. Here's how these unusual production results are obtained on oil well slush pump liners.

Two Microhoning operations (rough and finish) are performed on the bores of these hardened (64-66 Rockwell "C") liners. Bore diameters range from 4.50" to 7.75" and lengths are up to 28". The rough Microhoning removes approximately .090" of stock at an average clip of .0045" per minute and generates a 20 microinch (rms) finish.



Fixturing includes hydraulic end clamping to handle liners from 14" to 28" long. Adjustable hydraulic loader handles varying diameters. Heavy-duty Micromold tooling allows the use of more abrasive for faster stock removal. One tool handles a range of bore diameters.

A new stonefeed assembly, capable of exerting a five-ton thrust, permits this stock-removal performance. When the Microhoning tool enters the bore, the abrasives are instantly expanded against the bore surface. As contact is made, a sensing device de-energizes the rapid feed and a pre-set regular feed rate controls further expansion. At the end of the automatically timed Microhoning cycle, the tool is instantly collapsed and withdraws from the bore.

Changeover from rough to finish Microhoning requires only the replacing of abrasives with finer-grit sticks and resetting of timer to shorter cycle—less than 90 seconds is needed for changeover. Finish Microhoning time is about two minutes, roundness and straightness are held within .0005" variation throughout the length of bore, and surface finish of 6-8 microinches (rms) is generated.

MMT-PE

Visit Us In Booth 1225 — The Machine Tool Exposition

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a. its new transformer (Miller designed and built) has integral flux diverter.
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c. its new completely sealed semi-metallic rectifier — designed for welding — provides the most efficient d-c for welding ever devised.

These features contribute to the Gold Star SR's greater arc stability, denser welds, easy arc starting and flexibility to handle all electrodes in all positions.

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miller WELDERS

GOLD STAR *All-Weather* SRH

The features that set the SR above and beyond the normal standards of welder performance belong to the SRH also. But, in addition to the horizontal design for easier stacking and paralleling, this welder has an "all-weather" construction that includes baked varnish coated transformers and rectifiers plus phosphatizing and painting of all base and sheet metal — even fan blades. Cam-Lok receptacles are standard equipment. The Gold Star SRH welds real well.

Complete specifications on these Gold Star models will be sent promptly.

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The 1960 Buyers' Guide Issue of American Machinist/Metalworking Manufacturing—published in September, 1959—includes the biggest list of product sources ever. Over 3,400 manufacturers have listed their products under 1,800 different headings. Meanwhile, when you need something refer to your 1959 Buyers' Guide. It's a tremendously valuable source.

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The AMERICAN MACHINIST'S HANDBOOK

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Close ganging of tools presents no adjustment problems with the Kendex Dial-A-Breaker. *All* changes and adjustments . . . chipbreaker and insert . . . can be made from the top of the holder. (The clamp screw is also accessible from the bottom of the tool when mounted in an inverted position on the rear carriage.)

Kendex Dial-A-Breaker Tool Holders have the same basic design and accommodate the same solid Kennametal shims and "throw-away" inserts as used in standard Kendex holders. They are available in positive or negative rake, and with square or triangular inserts.

Get more information. Ask your Kennametal Representative for a demonstration . . . or write KENNAMETAL INC., Latrobe, Pa. 33501

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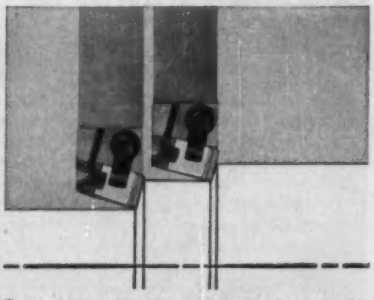
Holders illustrated with clamps and chipbreakers removed show positive seating of both triangular and square inserts. When not required, tool may be used without chipbreaker, with clamp set directly on the insert.



Easily accessible for adjustments. Permits close ganging of tools.

Easy adjustment, regardless of tool position. Just release the clamp and "dial" the breaker to any position desired.

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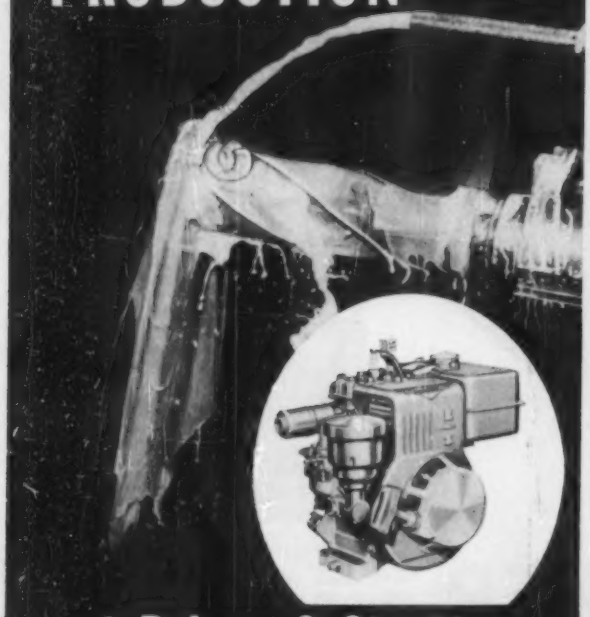

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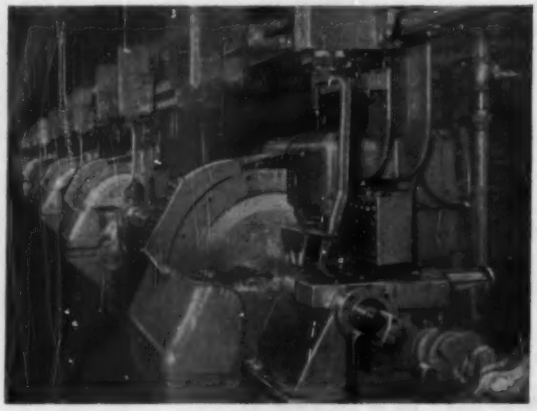

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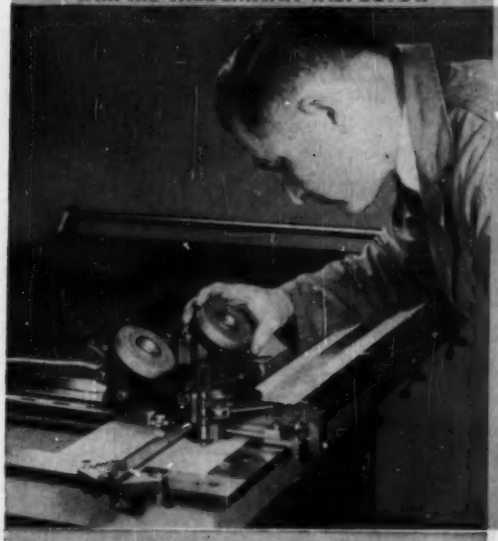

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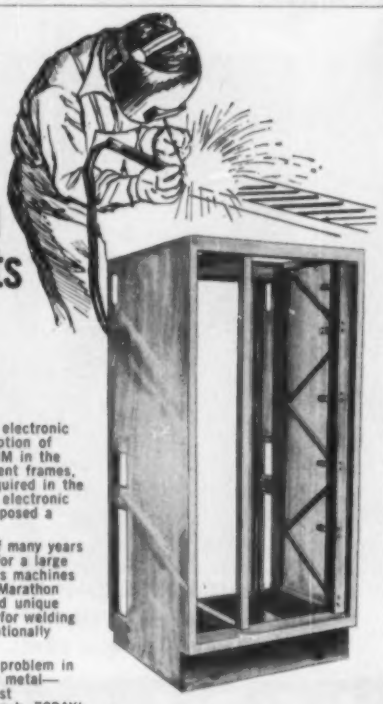

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WHAT HAPPENS WHEN A NATION SPENDS MORE ON GAMBLING THAN IT SPENDS FOR HIGHER EDUCATION?

If you can find any Romans around, ask them. They lived pretty high on the hog in their day. That is, until some serious-minded neighbors from up North moved in. The rest is ancient history.

You'd think their fate would have taught us a lesson.

Yet today we Americans spend twenty billion dollars a year for legalized gambling, while we spend a niggardly four-and-a-half billion for higher education. Think of it! Over four times as much! We also spend six-and-a-half billion dollars a year for tobacco, nine billion dollars for alcoholic beverages, and billions more on other non-essentials.

Can't we read the handwriting on the wall?

Our very survival depends on the ability of our colleges and universities to continue to turn out thinking men and women. Yet today many of these fine institutions are hard put to make ends meet. Faculty salaries, generally, are so low that qualified teachers are leaving the campus in alarming numbers for better-paying jobs elsewhere.

In the face of this frightening trend, experts estimate that by 1970 college applications will have doubled.

If we are to keep our place among the leading nations of the world, we must do something about this grim situation before it is too late. The tuition usually paid by a college student covers less than half the actual cost of his education. The balance must somehow be made up by the institution. To meet this deficit even the most heavily endowed colleges and universities have to depend upon the generosity of alumni and public spirited citizens. In other words, they depend upon *you.*

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Long lasting—Simple design, rugged construction make Wilson Superficial testers as durable as a machine tool.

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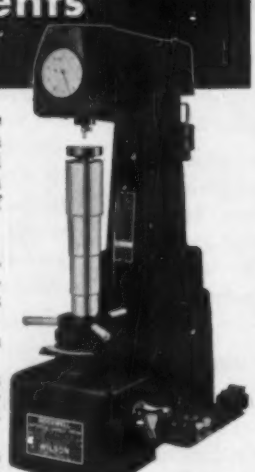
Write for details—Ask for Catalog RT-58. It gives complete information on the Superficial tester as well as on the full line of Wilson Rockwell hardness testers.



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The numbers after the advertiser's name, indicates the products or services offered by the advertiser.

2. Automatics
6. Boring Mills
7. Broaching Machines
10. Chucking Machines
13. Cutting Off Machines
16. Drilling & Reaming Machines
19. Fabricating Equipment
24. Gear Cutting Machines
25. Grinding Machines
27. Honing & Lapping Machines
29. Keyseaters
30. Lathes
31. Liquidating & Appraising Plants
32. Machine Tools
36. Milling Machines
40. Planers
43. Press Brakes
44. Presses
51. Saws
53. Shapers
54. Shears

ADVERTISER	Page No.	KEY TO PRODUCTS OR SERVICES
Cincinnati Machinery Co.	211	6, 10, 16, 25, 30, 40
Cook County Machinery Co.	211	19, 32
Eastern Machinery Co.	211	25, 27, 29
Falk Machinery Co.	211	2, 6, 16, 25, 30, 36, 44, 51, 53, 54
Goldman, Harvey & Co.	209	7
Graff Machinery Tool Co.	210	13, 16
Hyman, Jos. & Sons	211	43, 44, 54
Midwestern Machinery Co.	211	2, 16, 24, 25, 30, 31, 36, 44, 51, 53, 63
Noll Equipment	211	24, 25
Petrus Machinery Inc.	211	54
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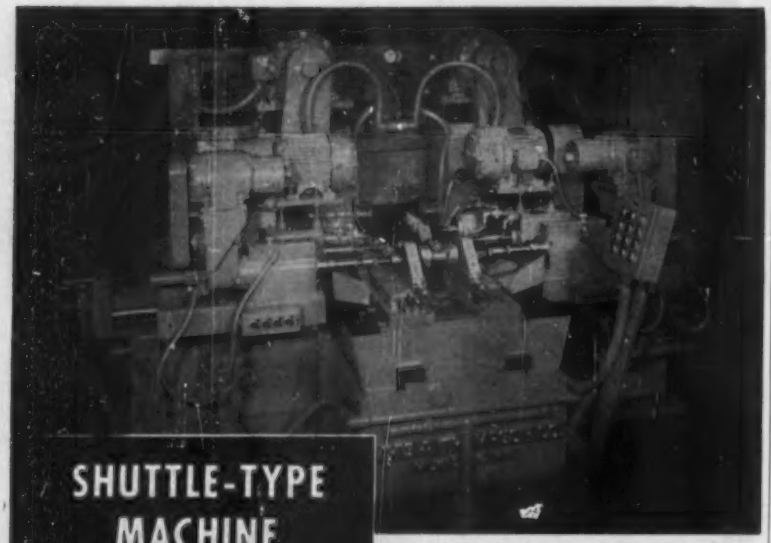

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	Page
Adamas Carbide Corporation	155
Air Express Division Railway Express Agency	173
Allegheny Ludlum Steel Corporation	24
Allen-Bradley Co.	129, 130
Allison-Campbell Division American Chain & Cable Co., Inc.	196
Aluminum Company of America	199
American Chain & Cable Co., Inc. Allison-Campbell Div.	196
Wilson Mechanical Instrument Division	208
American Machinist/ Metalworking Manufacturing	174-175
American Sip Corporation	3rd Cover
American Smelting & Refining Company	189
American Stock Gear Div. Perfection Gear Co.	188
American Tool Works Company	95
Ames Company, B. C.	214
Armstrong Brothers Tool Company	60
Atlas Press Company Clausing Division	185
Atrax Company	57
Austin Industrial Corporation	192
B & T Machinery Company Div. of Greenlee Bros. & Company	86
Baird Machine Company	186
Bath & Company, Inc., John	164
Beaver Pipe Tools, Inc.	184
Behr-Manning Company Division of Norton Company	27
Bendix Aviation Corporation Industrial Controls Section	179, 181
Berthiez	53
Black & Webster, Inc.	50
Black Diamond Saw & Machine Works	208
Blake Company, Edward	208
Bliss Company, E. W.	96
Brown & Sharpe Mfg. Company	75
Bryant Chucking Grinder Company	98
Bullard Company	84
Butterfield Division Union Twist Drill Company	21
Carborundum Company	70-71, 167
Carpenter Steel Company	55
Chambersburg Engineering Company	178
Chicago Screw Company	26
Cincinnati Gilbert Machine Tool Company	40
Cincinnati Milling Machine Company Milling Machine Division	5, 6-7
Cincinnati Milling Machine Company Grinding Wheels Division	39
Clark Instrument Inc.	166

ADVERTISERS INDEX

	Page
Clausing Division of Atlas Press Company	185
Cleveland Crane & Engineering Company	48
Columbia-Geneva Steel	35
Commander Manufacturing Company	206
Cross Company	18-19
Crucible Steel Company of America	46
Cushman Chuck Company	88
Dake Corporation	187
Davis & Thompson Company	212
Dearborn Gage Company Ellstrom Standards Division	172
Delta Power Tool Division Rockwell Manufacturing Company	42-43
du Mont Corporation	72
Eldorado Tool & Manufacturing Corporation	198
Elgin National Watch Company Abrasives Division	168
Emhart Manufacturing Company	165
Fairbanks, Morse & Company	44
Federal Products Corporation	177
Fellows Gear Shaper Company	8-9
Felters Company Unisorb Division	182
Finkl & Sons Company, A.	193
Fiske Brothers Refining Company Lubriplate Division	194
Gear Specialties, Inc.	163
General Electric Company	157-158
Gisholt Machine Company	25
Gleason Works	49
Goss & de Leeuw Machine Company	176
Grant Manufacturing & Machine Company	172
Gulf Oil Corporation	58-59
Hanson-Whitney Company	191
Hardinge Brothers, Inc.	16,
Harig Manufacturing Corporation	190
Hartford Machine Screw Company	26
Heald Machine Company Sub. Cincinnati Milling Machine Co.	2nd Cover
Hermes Corporation	206
Hoover Ball & Bearing Company	45
Ingersoll Milling Machine Co.	134
Johnson Bronze Company Sub. Apex Bronze & Foundry Company	138
Jones & Lamson Machine Company	20
Kaiser Aluminum & Chemical Sales Inc.	30-31
Kennemetal Inc.	203
Kent-Owens Machine Company	170
Kerns Company, L. R.	204
Ladish Co.	65
Landis Machine Company	10-11
Landis Tool Company	12-13, 17
LaPointe Machine Tool Company	22-23
LeBlond Machine Tool Company, R. K.	82
Lees-Bradner Company	61
Littell Machine Co. F. J.	47
Lubriplate Division Fiske Brothers Refining Company	194
Lucas Machine Division New Britain Machine Company	33, 34
Ludwigsburger Maschinenbau GMBH	56
Marathon Industries, Inc.	206
Metal Carbides Corporation	180
Metallurgical Products Dept., General Electric Company	77-80
Micromatic Hone Corporation	200-201
Micro Switch A Division of Honeywell	76
Miller Electric Manufacturing Co., Inc.	202
Mobil Oil Company	28-29
Morse Twist Drill & Machine Company	41
National Acme Co.	36-37
National Broach & Machine Company	136
New Britain Machine Company Lucas Machine Division	33, 34
Newton Hydraulic Tooling Co. Inc.	153
Niagara Machine & Tool Works	169
Norgren Company, C. A.	64
Norton Company	51
Optical Gaging Products, Inc. A Subsidiary of Ex-Cell-O Corp.	52
Pacific Industrial Manufacturing Co.	132
Perfection Gear Company American Stock Gear Division	188
Precision Welder & Flexopress Corp.	140
Railway Express Agency Air Express Division	173
Randall Co. Inc. Frank E.	212
Republic Steel Corporation	66-67
Ryerson & Son, Inc., Joseph T.	90
Scherr-Tumico	208
Schrader's Son, A., Division Scovill Manufacturing Co., Inc.	38
Sheffield Corporation of Bendix Aviation Corporation	32
Simonds Saw & Steel Company	92
Standard Oil Company (Indiana)	62-63
Standard Screw Company	26
Starrett Company, L. S., The	139
Steelweld Machinery Division Cleveland Crane & Engineering Company	48
Sundstrand Machine Tool Company Division of Sundstrand Corp.	68-69
Sun Oil Company	73
Tennessee Coal & Iron	35
Texas Instruments Incorporated Metals & Controls Division	195
Timken Roller Bearing Company Steel & Tube Division	4th Cover
United States Steel Corporation	35
United States Steel Export Company	35
United States Steel Supply	35
Vanadium-Alloys Steel Company	161
Van Keuren Company	74
Vlier Engineering Corporation Sub. Barry Controls Inc.	131
Warner & Swasey Company	14-15
Weldon Tool Company	183
Western Automatic Machine Screw Company	26
Wickes Machine Tool Company Div. of the Wickes Corporation	204
Wiedemann Machine Company	205
Wilson Mechanical Instrument Division American Chain & Cable Company, Inc.	208
Woodworth Company, N. A.	54

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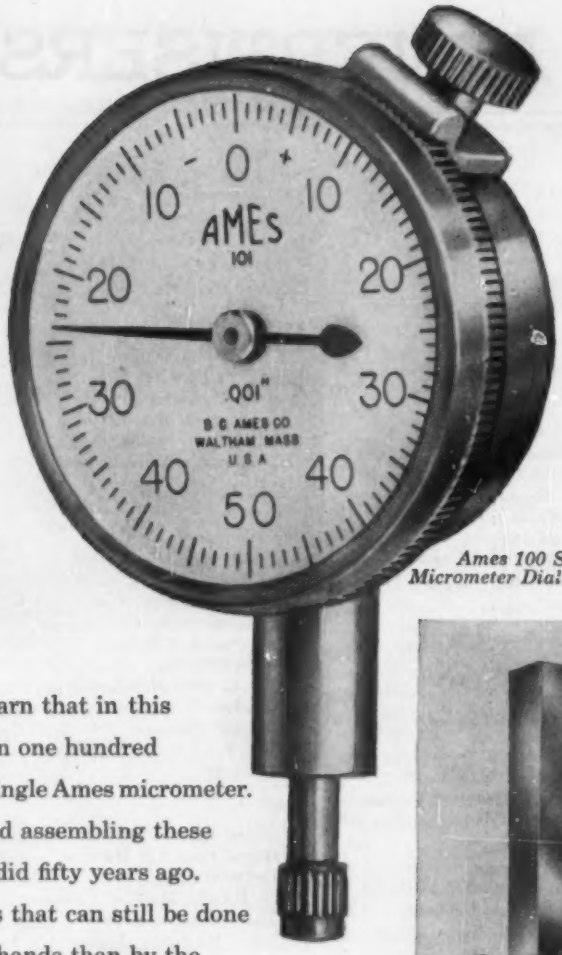

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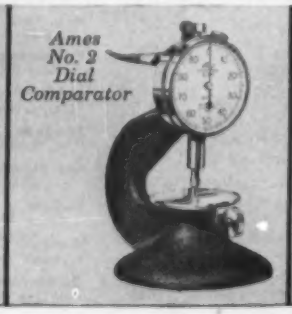

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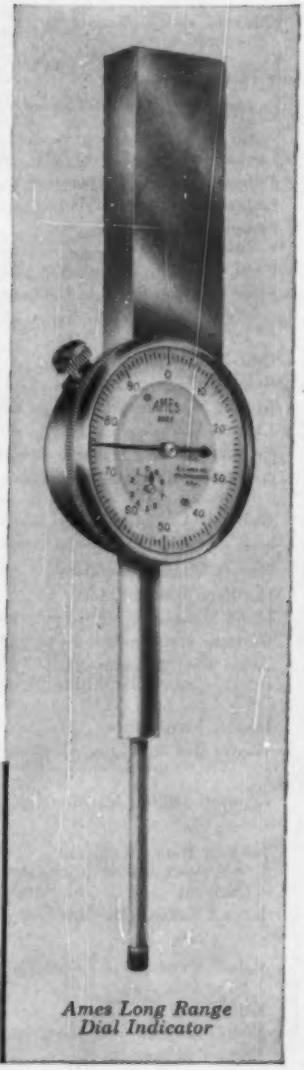

Ames Long Range Dial Indicator

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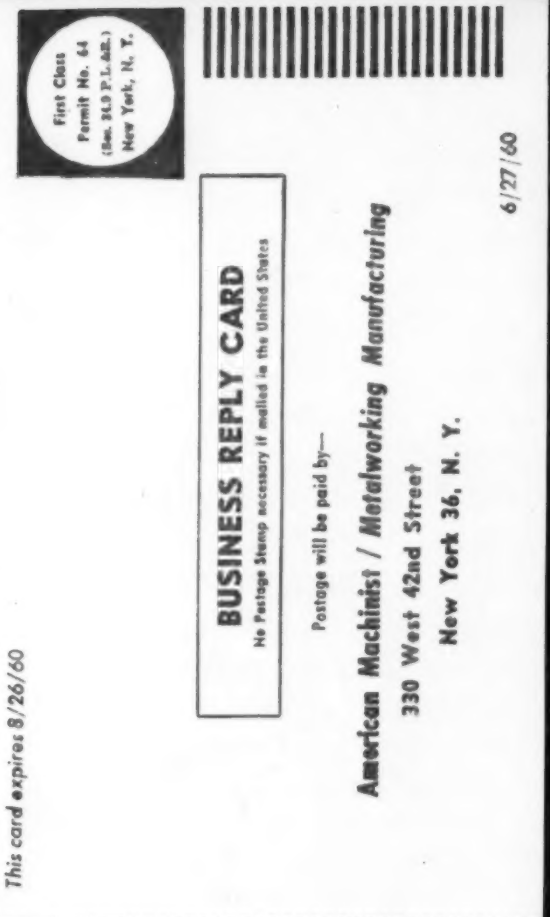
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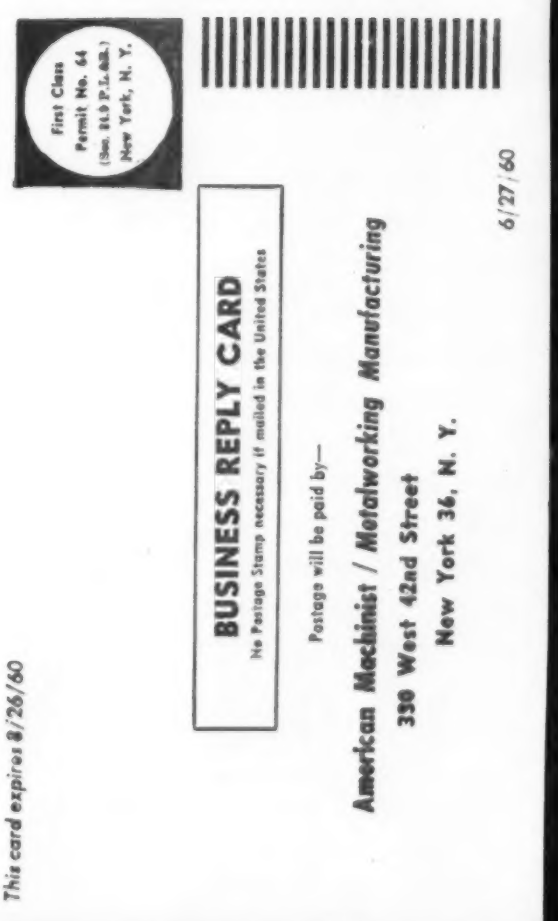
This card expires 8/26/60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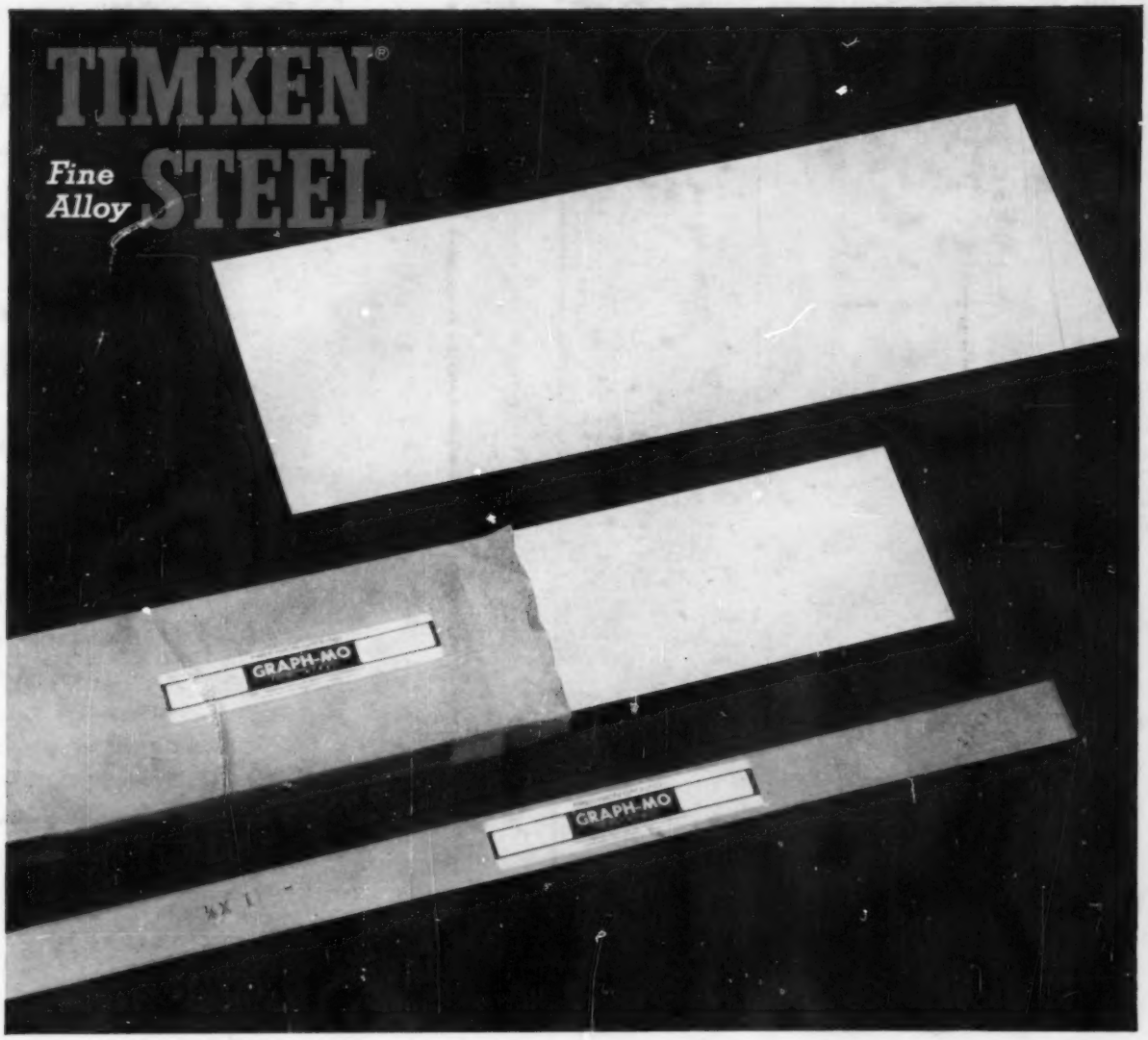

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TIMKEN GRAPHITIC STEELS ARE AVAILABLE FROM STEEL SERVICE CENTERS IN 40 CITIES IN THE UNITED STATES AND CANADA

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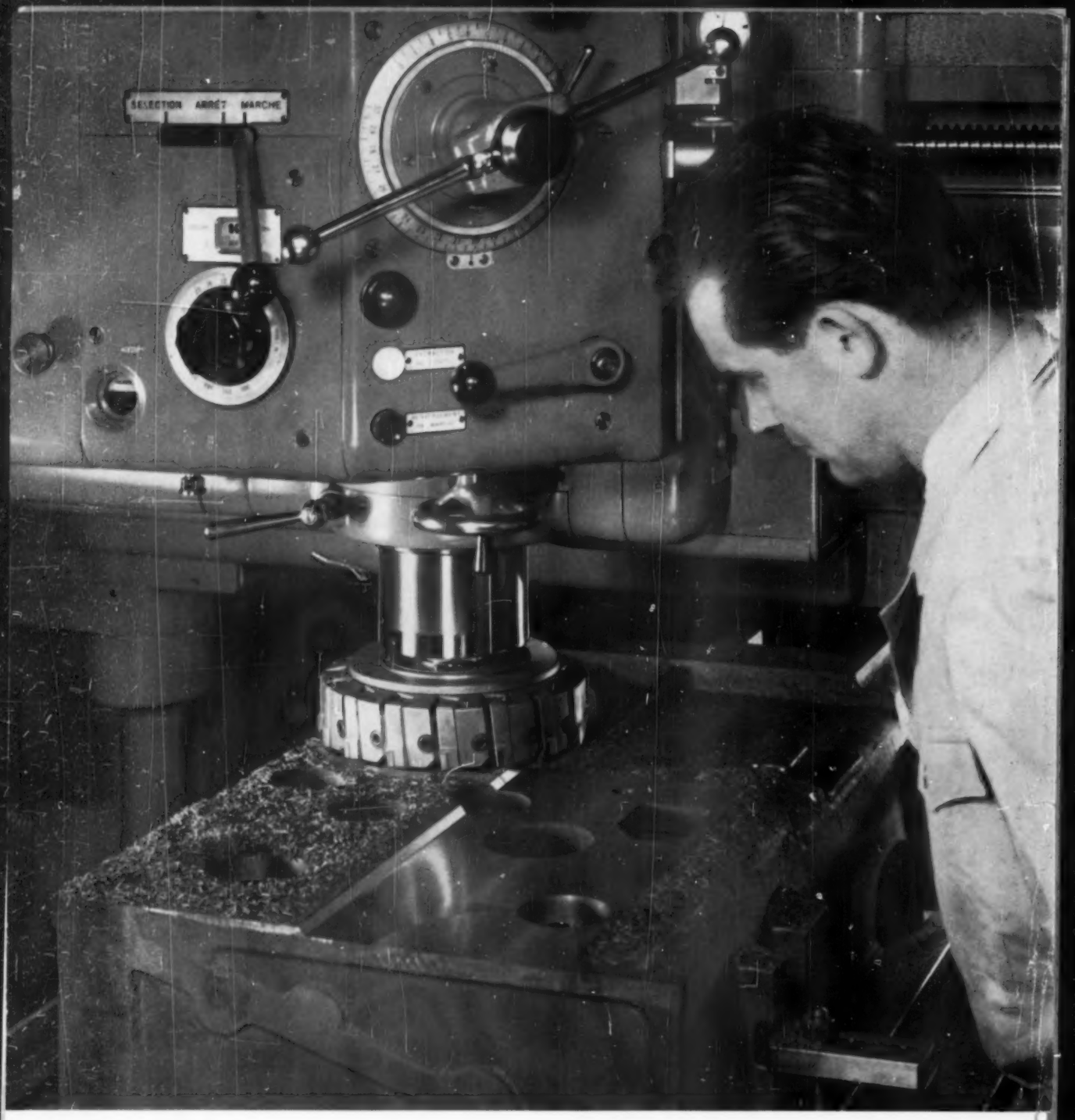

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